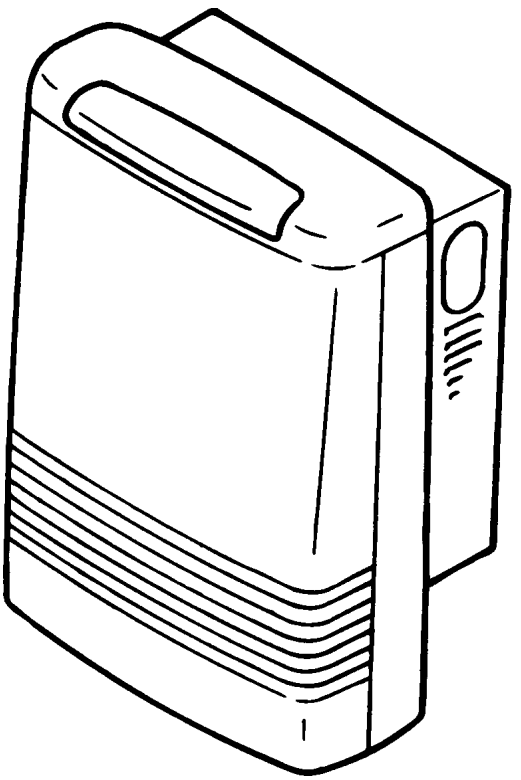
Rinnai Energysaver

ENERGYSAVER
RHFE-308FTR

SERVICE MANUAL



High Efficiency Power Flued Gas Space Heater

Proudly a member of The Australian Gas Association.
All of our products are AGA tested and approved.

The Australian
Gas Association

Quality System

Quality
Endorsed
Company

ISO 9002 Lic 4983
Standards Australia

Distributed and serviced in Australia under a Quality System certified as complying with ISO 9002 by Quality Assurance Services.

Rinnai New Zealand has been certified to ISO 9001 Quality Assurance by Telarc.

TELARC REGISTERED SUPPLIER

Quality
Endorsed
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ISO 9001 Reg 415

Certified
Product

WaterMark

AS3498 Lic W208
Standards Australia

Certified to Australian Standard 3498 by Quality Assurance Services. Watermark certification is awarded to products with suitable fittings complying with safety and water contamination standards.

Comparative Energy Consumption tested to The Australian Gas Association requirements of Australian Gas Code AG 102. An energy rating of 5 stars refers to an efficiency of approximately 80%, that is, 80% of gas consumed is converted to useful heat.

THE MORE STARS THE MORE ENERGY EFFICIENT

GAS
ENERGY RATING

USE THIS LABEL TO COMPARE DIFFERENT MODELS.
THE AUSTRALIAN GAS ASSOCIATION

ISO 9001	*Model for Quality Assurance in design/development, production, installation and servicing, aimed primarily at achieving customer satisfaction by preventing nonconformity at all stages from design through to servicing.*
ISO 9002	*Same as ISO 9001 but excluding design.*
AS 3498	*Authorisation requirements for plumbing products - water heaters and hot-water storage tanks, aimed at ensuring safe, quality products.*
AG 102	*Approval requirements for gas water heaters as set by The Australian Gas Association and Australian Liquefied Petroleum Gas Association Ltd, to ensure proper safety performance and quality levels are achieved.*

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July 1998

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WARNING

Failure to comply with these instructions may result in serious personal injury or damage to the appliance.

ALL WIRING INSIDE THIS APPLIANCE MAY BE AT 240 VOLTS POTENTIAL

ALL SERVICE WORK MUST BE CARRIED OUT BY AN AUTHORISED PERSON.

DO NOT TEST FOR GAS ESCAPES WITH AN OPEN FLAME

This manual has been compiled by Rinnai Australia Customer Technical Services. While many individuals have contributed to this publication, it will be successful only if you - the reader and customer - find it useful. We would like to extend an invitation to users of this manual to make contact with us, as your feedback and suggestions are valuable resources for us to include as improvements. Rinnai are constantly working toward supplying improved appliances as well as information, and specifications may be subject to alteration at any time.

SRV308
Issue Nº1

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Glossary of Terms and Symbols

This glossary of terms and symbols is provided to assist you in understanding some of the language used throughout this manual.

dB(A)	-	sound pressure level in decibels, “A” range
DC	-	direct current
AC	-	alternating current
Hz	-	Hertz
IC	-	integrated circuit
kcal/h	-	kilocalorie per hour
kPa	-	kilopascals
LED	-	light emitting diode
L/min	-	Litres per minute
mA	-	milliamps
MJ/h	-	megajoule per hour
mm	-	millimetres
mmH_2O	-	millimetres of water (gauge pressure)
NO_X	-	oxides of nitrogen (NO & NO_2)
OHS	-	overheat switch
PCB	-	printed circuit board
CPU	-	central processing unit
POT	-	potentiometer
rpm	-	revolutions per minute
SV	-	solenoid valve
ø	-	diameter
$\Delta°C$	-	temperature rise above ambient
POV	-	modulating valve
TH	-	thermistor

1. Introduction

Background

The RHFE-308FTR incorporates an improved modulating control system to provide comfortable heating. Other features of these appliances are improved safety, operation, installation, and maintenance features.

Characteristics

- Built into the main PCB is the software for connection to a central ON-OFF control.
- Gas flow modulates in 7 steps between High and Low ensuring comfortable and efficient heating.
- Includes a 24 hour digital clock and dual timer, and an economy mode function. This reduces gas consumption without affecting comfort.
- Temperature control is monitored by "fuzzy logic" technology - relevance to each other.
- All operation and temperature control is with user-friendly push buttons.
- Improvements have been made to the rear convex section for clean-cut design.
- If a problem occurs or service is required, an error coded message appears on the digital display to direct the service technician to the cause of the problem.
- Information about any previous faults is stored in the PCB and can be recalled during servicing.

About the 308FTR

The bodywork is formed from 0.6 mm galvanised steel sheet, which forms a box to which the components, heat exchangers and blowers are attached. This is then covered by an outer case which is constructed from 0.6 mm galvanised steel sheet, and plastic mouldings.

The combustion chamber is constructed from 1.0 mm hot dip aluminium coated steel sheet, located in the lower centre of the appliance.

The heat exchanger is composed of two sub-heat exchanger sets. The left hand set, N^{o}1 is constructed of 1.0 mm aluminised steel. The right hand set, N^{o}2 is constructed of 0.8 mm stainless steel. The inlet of sub-heat exchanger N^{o}1 is connected to the outlet of the combustion chamber, the outlet is connected to sub-heat exchanger N^{o}2. Sub-heat exchanger N^{o}2 consists of 3 "sub" sections, constructed from 0.8 mm stainless steel. The outlet of sub-heat exchanger N^{o}2 is constructed from 0.5 mm stainless steel and connected to the flue by a concertina stainless steel tube.

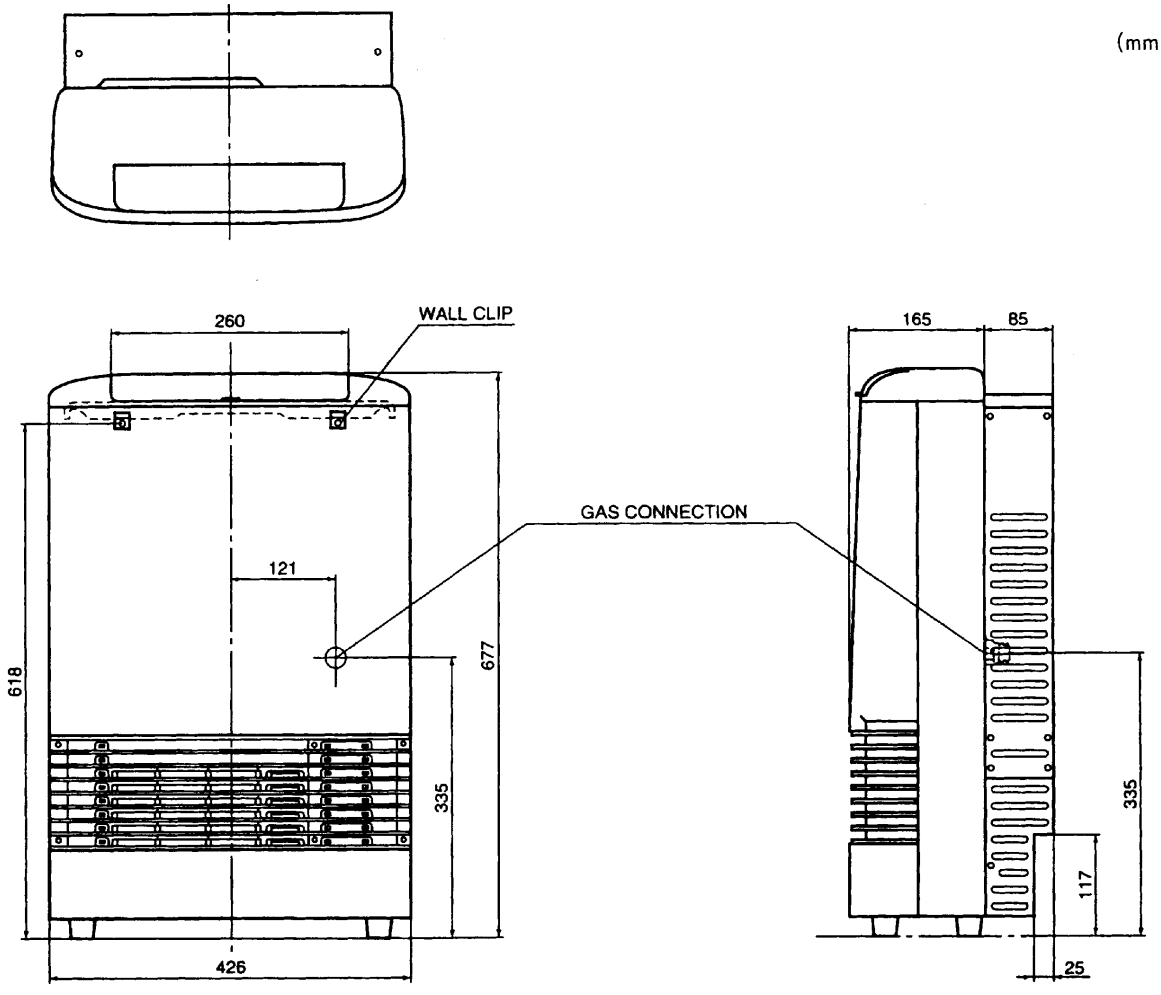
The combustion air fan draws combustion air from the outside atmosphere through the flue manifold pipe. Air is then blown into the combustion chamber via a rubber tube. Combustion products in the combustion chamber are pushed out into sub-heat exchanger N^{o}1, to sub-heat exchanger N^{o}2, and then into the 34 mm flue pipe which is connected through the flue manifold to the outside atmosphere.

The flue system is connected with stainless steel concentric pipe. The inner pipe (34 mm diameter.) is the combustion gas outlet, and is connected to the outlet of sub-heat exchanger N^{o}2. The outer pipe (70 mm diameter) is the combustion air inlet and is connected to the inlet of the combustion fan air pipe. Various flue lengths are available.

Ignition is continuous spark in conjunction with an electrically operated solenoid and control is monitored by the PCB. Gas passes through the R½ 15 (BSP) inlet fitting, then via a flange connection to the solenoid valves N^{o}1, N^{o}2, a regulator modulating valve, aluminium injector manifold, before entering the burner.

2. Dimensions

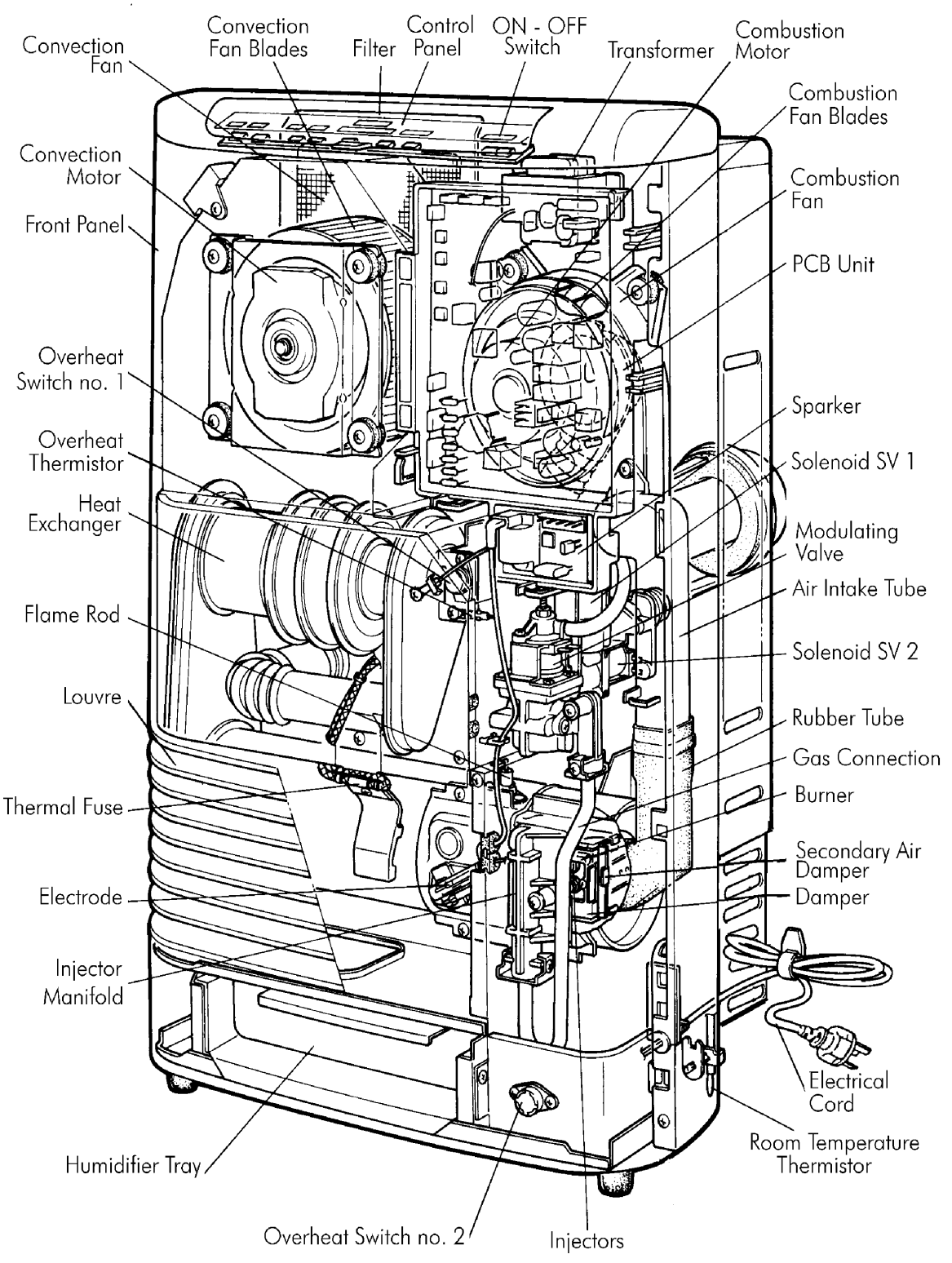
Note: All dimensions are in millimetres



3. Specification

Type of appliance	Fan forced flued gas space heater
Model	RHFE-308FTR
Dimensions	Width - 425 mm Depth - 165 mm (with back spacer 250 mm) Height - 677 mm
Weight	Approx 17 kg
Connections	Electrical - AC 240 V 50 Hz / 60 Hz Gas - R½ 15 BSP male threa
Electrical Consumption	High: 39 W Low: 30 W
Output	10.5 MJ/h
Combustion system	Stainless steel bunsen burne
Ignition system	Continuous electrical spark, direct to main burner
Operation	Finger touch control buttons
Temperature control	Electronic thermostat, modulating HI-LOW/OFF
Temperature range	LOW (10^oC), 16 ~ 26^oC (1^oC increments), HIGH (continuous)
Warm air outlet	Bottom of appliance
Air volume control	HI ~ LOW (automatic)/OFF
Timer operation	Dual Timer - 24 hour, ON & OFF Timer Operation - 24 hour Clock - 24 hour digital display Temperature control - 26^oC limit when using timer program
Indicator	Burner ON, child lock, filter, economy, digital display, over-ride, clock setting, timer setting, timer, temperature display
Operating buttons	ON-OFF, up-down, child lock, economy, timer, clock setting, over-ride.
Humidifier tray	Capacity - 0.8 Litres
Safety devices	Flame failure - flame rod Over heat - bi-metal switch (130^oC, 90^oC) - thermal fuse (216^oC) - thermistor (130~90^oC) Power failure - PCB Power surge - 3 Amp fuse Fan delay - micro computer timer (Max 210 secs Pre-purge - combustion fan, pre-purge timer, spark sensor Room over heat - automatic cut off at 40^oC after 10 mins

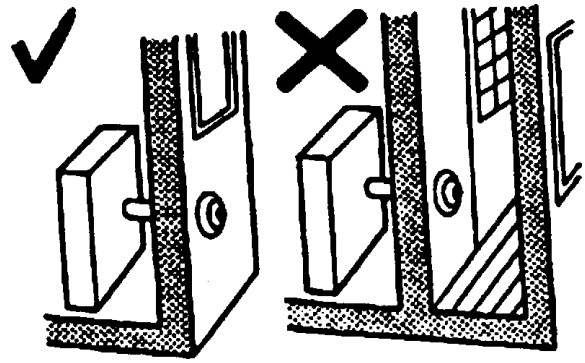
4. Cut-Away Diagram



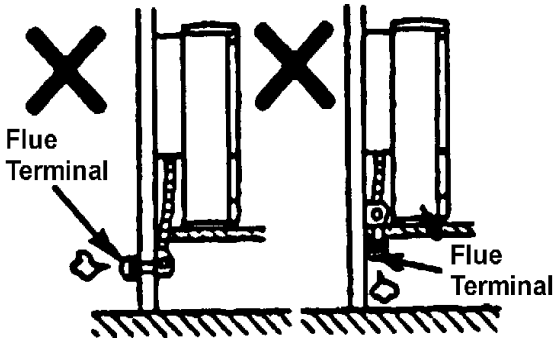
5. Installation

NOTE: The information provided here is only a guide. For full details on installation procedures, please refer to the installation instructions in the customer's operating instructions.

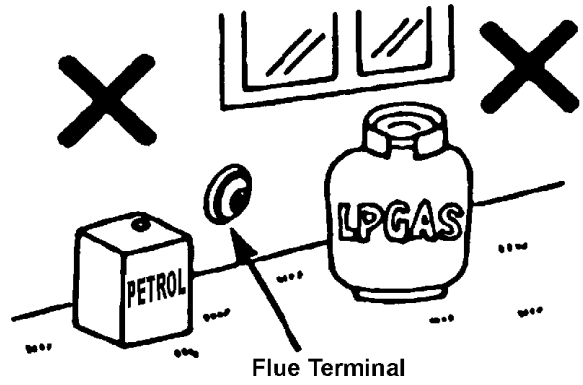
This heater is not designed to be built in.



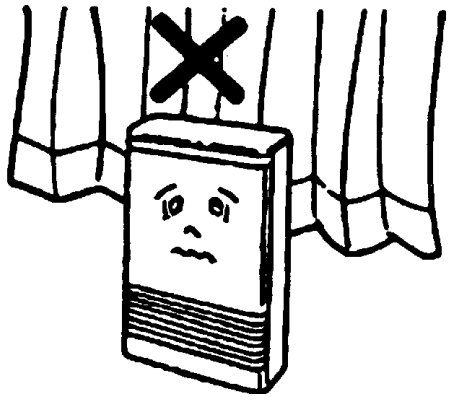
The flue may be positioned directly under opening windows, with a minimum clearance of 150 mm.



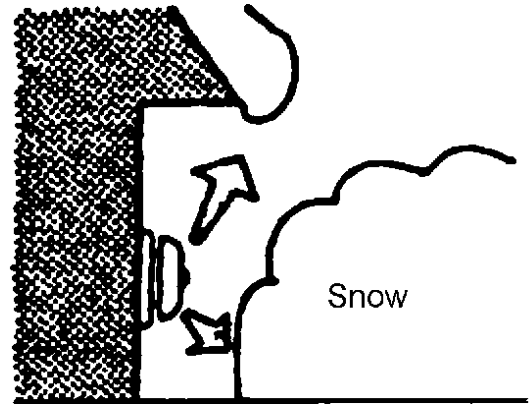
The flue is not designed to be positioned unde floors or below the level of the heater.



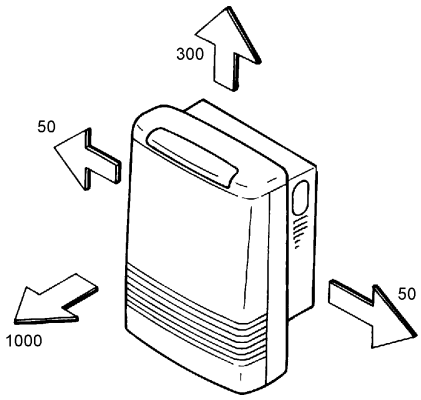
The flue terminal should be positioned away from flammable materials.

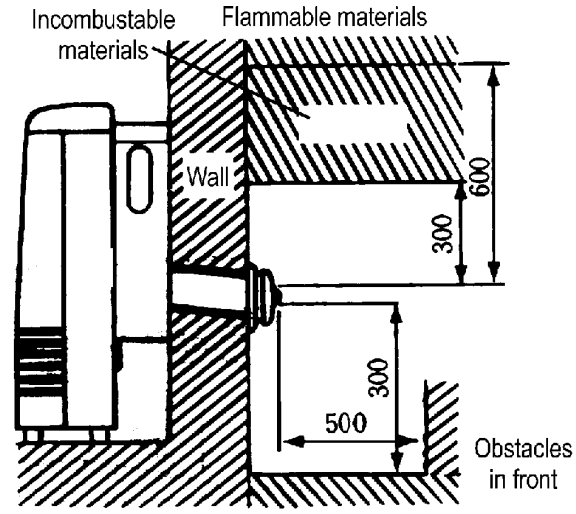


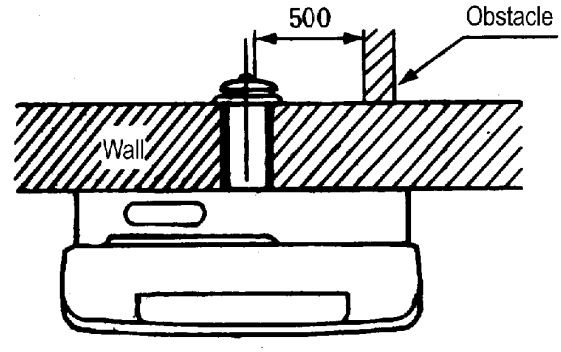
Flue fittings must be kept clear of flammabl materials.



In areas subject to heavy snowfall, keep snow clear of flue terminal at all times.







Recommended minimum clearances and distances from obstructions.

6. Performance Characteristics

1. Basic Combustion Specification

Item		Specification	
Rinnai model number		RHFE-308 FTR	
Gas typ		NG	Propane/LPG
Gas consumption MJ/h	HI	13	13
	LO	5	5
Injector size (∅ mm)		1.30	0.90
Injector quantity		2	2
Regulator pressure (kPa)	HI	0.60	1.04
	LO	0.12	0.19
Burner marking		P	P
Combustion method		Bunsen burner	
Burner type		Stainless slit style	
Solenoid valve		Direct single seated valve type	
Modulating solenoid valve		Direct single seated valve type	

2. Combustion Fan Speeds (rpm)

	Natural	Propane/LPG
Ignition	1710	1560
Re-ignition	1800	1680
Normal - High	3000	3090
Normal - Low	1440	1440

3. Warm Air Discharge Temperature Distribution

Condition: < High Combustion >

Test gas: Natural
Measured input: 12.55 MJ/h
Nominal input: 13 MJ/h
Room temperature: 25°C

(Unit Δ°C)

24	24	55	9
45	72	64	18
56	81	83	36
62	66	77	42
68	43	70	45
42	39	57	45

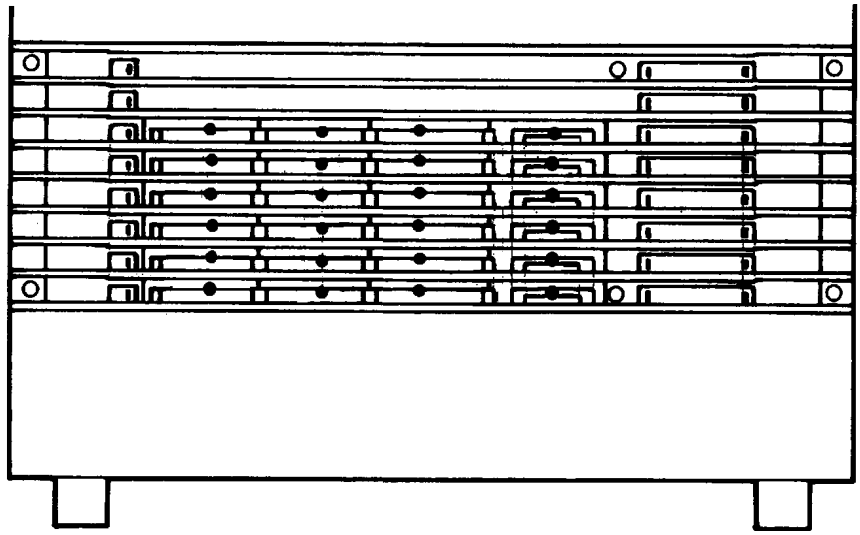
Condition: < Low Combustion >

Test gas: Natural
Measured input: 5.27 MJ/h
Nominal input: 5 MJ/h
Room temperature: 25°C

(Unit Δ°C)

10	17	30	9
23	39	38	13
29	48	42	28
35	44	46	37
37	28	43	34
22	26	31	28

4. Measurement Points



5. Warm Air Discharge Velocity

Convection Fan rpm HIGH: 740
LOW: 550
Room Temperature: 22°C

(Unit: m/sec)

1.62 1.46	2.57 1.32	1.70 1.34	1.08 0.84
1.99 1.78	2.57 1.92	2.89 2.15	2.12 1.58
3.20 2.61	3.54 2.53	3.12 2.44	2.51 1.91
3.35 2.66	3.44 2.60	3.14 2.28	2.75 2.08
3.27 2.47	3.37 2.52	3.33 2.62	3.32 2.46
3.13 2.37	2.11 1.23	3.33 2.54	3.42 2.58

Air Flow: Average air velocity on High: 2.784 m/sec
Average air velocity on Low: 2.10 m/sec
Air flow rate on High: 3.82 m^3/min
Air flow rate on Low: 2.89 m^3/min
Air flow outlet area: 0.0229 m^2

6. Noise Level

Unit: dB(A).

High	36.5
Low	31.5

7. Thermal Efficiency

Conditions: Horizontal mushroom flue with unit installed with back spacers.

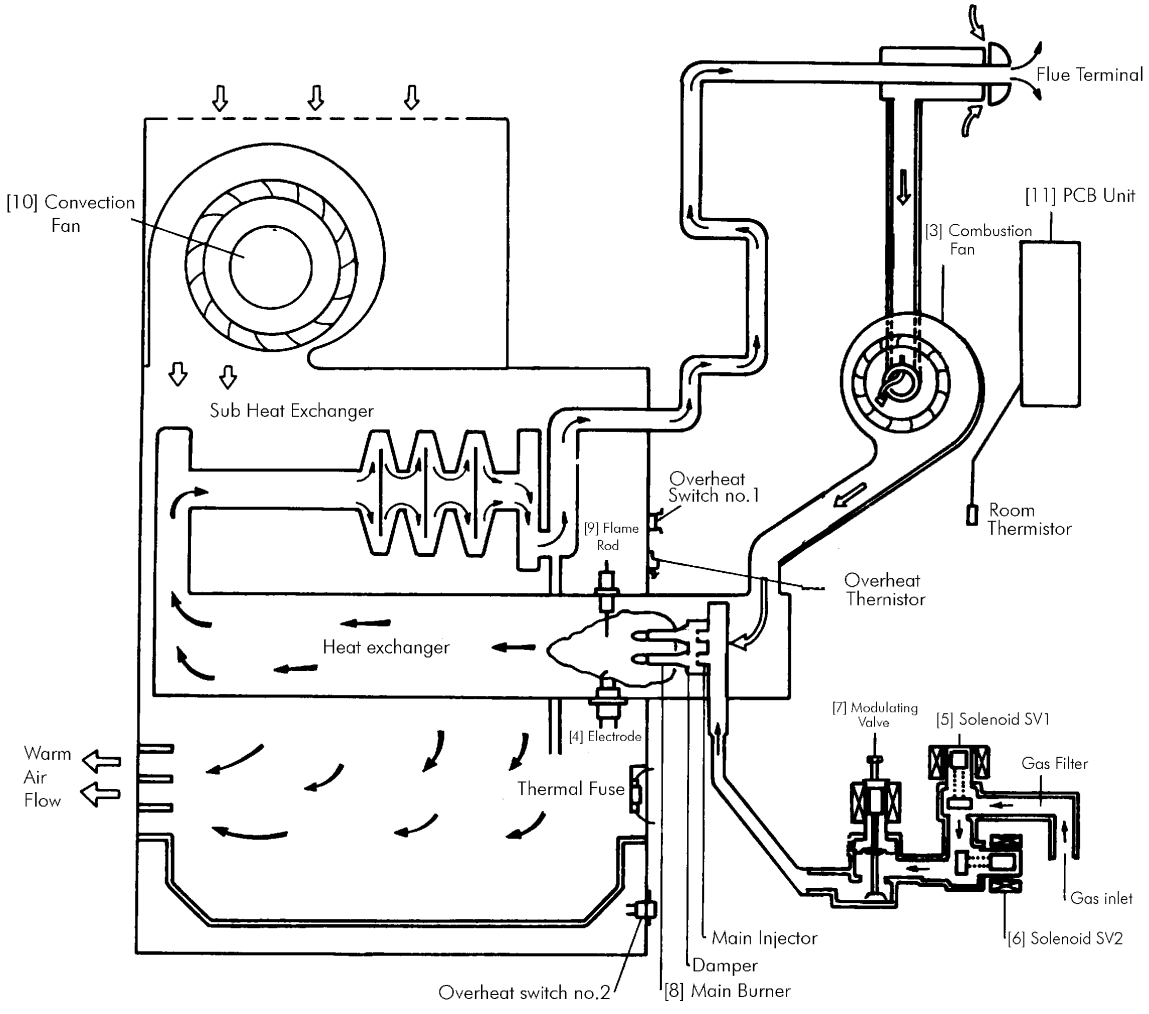
Gas Type	Combustion	Thermal Efficiency (%)
Natural	High	81.3
	Low	84.8
Propane	High	83.5
	Low	88.1

8. Humidifier Capacity

Method	Tray Capacity	Evaporation
Evaporation	0.8 Litres	0.1 Litres/hour

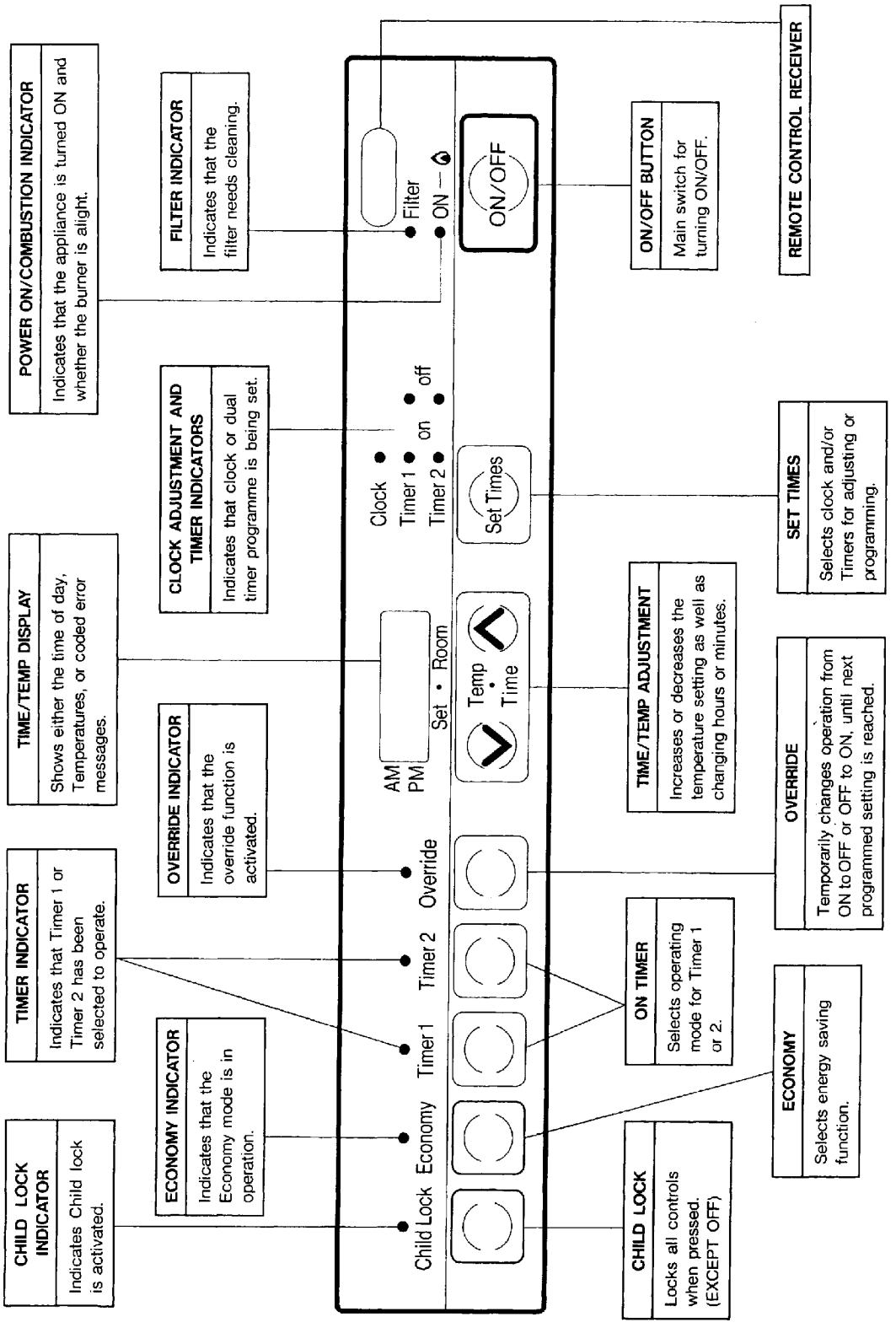
Note: Evaporation rate varies depending on conditions of use.
Conditions: Standard setting: High combustion
Measurement Method: According to JIS (Japanese Industrial Standard)

7. Schematic Diagram



8. Control Panel Layout

* Refer to “Appendix” on page 59 for explanation on setting clock and programming timers.



9. Operating Principles

1. Normal Operation

Push the ON/OFF Button to operate the appliance. The Power ON/Combustion Indicator will glow green. The combustion fan will run on high until pre-purge is completed.

Pre-purge is completed after approximately 15 seconds, following which, the combustion fan will decrease revolutions to enable ignition to occur. After the combustion fan reaches a pre-determined speed, (depending on gas type) the electrode produces the spark to begin the ignition cycle.

After the spark is sensed as having crossed the spark gap by the PCB, the solenoids (SV_1 & SV_2) as well as the modulating valve will open and allow gas to flow to the burner.

The flame rod senses the flame on the main burner. After the flame is sensed, the Power ON/Combustion Indicator changes to red and the spark stops. After an additional 15 seconds the convection fan begins to operate.

The room temperature is sensed by the temperature thermistor located at the rear of the appliance. The printed circuit board controls the air/gas ratio to the optimum level according to the selected temperature. The combustion fan is adjusted in conjunction with the opening degree of the modulating valve. The convection fan is adjusted in the same manner.

2. Thermostat Control

The selected and room temperatures are displayed on the Time/Temp Display. Time and temperature are displayed alternately depending whether the heater is running or not. The selected temperature is altered by pressing the Time/Temperature Adjustment buttons.

3. Turning Off

Simply press the ON/OFF Button. The solenoids, together with the modulating valve will close. The combustion fan will also stop, and all indicators will go out. After the burner extinguishes, the convection fan will continue to run for up to 210 seconds, ensuring the appliance is cool.

4. Economy Mode

To engage the economy function press the Economy button while the heater is operational. The Economy Indicator will glow. Once the selected temperature has been reached, the economy function is designed to drop this temperature by a total of $2^{o}C$ over a period of one hour. After 30 minutes the temperature will be reduced by $1^{o}C$. After a further 30 minutes the temperature will be reduced by another $1^{o}C$. This does not result in a loss to the heating effectiveness, and is an energy saving feature. You may press the Economy button again at any time, to cancel the economy function.

5. Child Lock

To activate the child lock press the Child Lock button. The Lock Indicator will glow.

If the child lock is activated during normal operation, then no functions other than the ON/OFF Button will be operable until the lock is released.

If the child lock is activated whilst the appliance is OFF, then the complete range of functions will be locked.

6. Filter Indicator

When the air filter becomes covered in dust and the temperature inside the appliance rises, the Filter Indicator will glow.

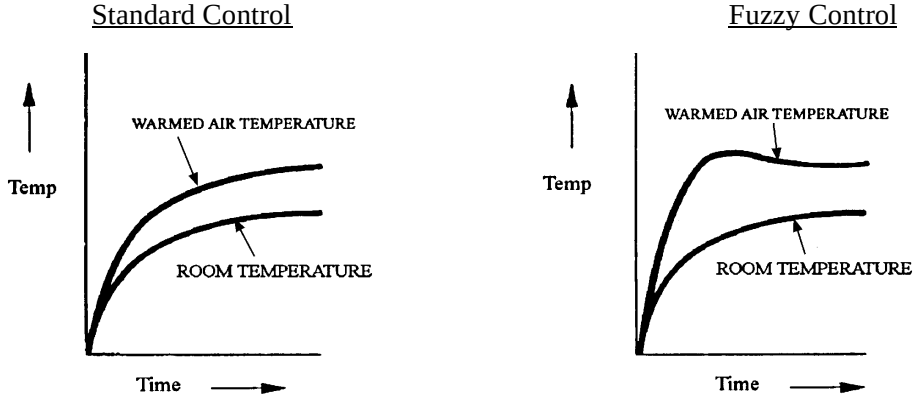
7. Fuzzy Logic

a. The Purpose of Auto Comfort [Fuzzy Logic]

The main aim of the Auto Comfort function is to heat a room by controlling the flow of the warm air coming from the heater. This increases heating efficiency as well as improving control over the flow of warm air being discharged by the appliance.

In order to achieve comfortable heating, it is preferable to avoid cold drafts or draughts from the appliance. Also, for increased efficiency it is important to reduce overheating in the room and concentrate heating in the area where people are most often situated.

Fuzzy Logic is used in order to achieve the following improved heating pattern.



'Room temperature' and 'the time elapsed since the start of combustion' are the basis for fuzzy logic. Th means of control is the speed of the convection fan and modulation of gas combustion.

b. Fuzzy Logic Summarised

In the case of a conventional fan heater, the convection fan operates normally from the time of ignition, and a cold draught may accompany the flow of air from the appliance. To solve this problem, fuzzy logic controls the speed of the convection fan after taking into consideration the room temperature at the time of ignition. For example, in the case of the room temperature being low, the fan is made to rotate at a low speed, raising the discharge air temperature. As the room temperature rises, the speed of the convection fan is gradually increased. In this way it is possible to ensure a comfortable volume of warmed air whilst decreasing the possibility of cold draughts immediately after ignition.

The fan speed increases proportionally as time passes and the room gradually heats up. This improves the warm air distribution, assisting in a reduction of stratification throughout the room and resulting in more effective heating conditions. The PCB then continually monitors the room temperature, and adjusts the fan speed according to the conditions at the time.

8. Clock and Timer Setting and Operation

Refer to "Appendix" on pa ge59 of this manual.

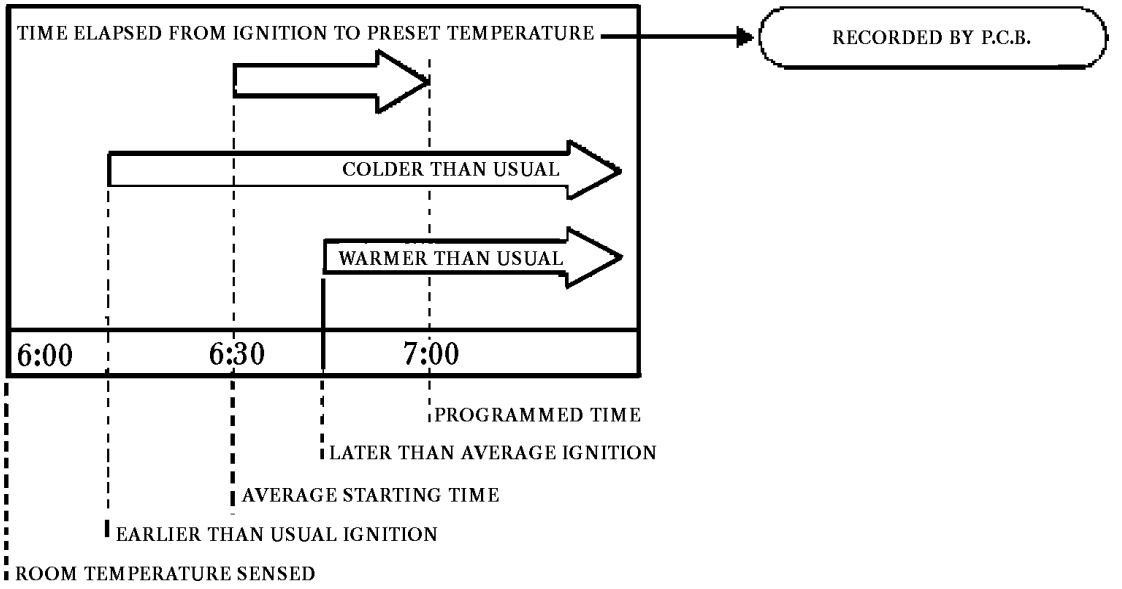
9. Intelligent Timer [Pre Heat]

This function enables the room to be heated to the pre-set temperature prior to the time programmed in the On Timer. See Intelligent Timer [Pre-heat]" on pa ge14 for more information.

10. Intelligent Timer [Pre-heat]

The Intelligent 2-way 24-hour programmed dual digital Timer [Pre-Heat] function operates in conjunction with either “On-Timer”. It enables the pre-set temperature to be reached by the time programmed by starting ignition up to an hour before the time programmed to start heating.

The actual ignition time is calculated using the difference between the room temperature and set temperature and the warming-up time which elapsed the last time the appliance was used. The maximum time ignition will precede the pre-set time is 1 hour. The following chart illustrates how the intelligent timer operates.



The two timers can be programmed and used individually, or sequentially. Timer operation, once set, will remain on stand-by for the next day after the final OFF sequence, unless ON/OFF switch is pressed.

11. Safety Devices

Flame rod sensor

Senses main burner ignition and shuts off the solenoid valves when the flame current drops below 0.1μA.

Spark sensing circuit

Senses the location of spark and opens the solenoid valves only when the spark location is confirmed as correct.

Pre-purge circuit

Purges heat exchanger and flue prior to spark commencing.

Combustion fan rpm sensing circuit

Senses the operation of the combustion fan and maintains a pre-determined rotation speed.

Overheat protection switches

Shuts off the solenoid valves and cut off gas supply in the case of over heating.

i) Bimetal OHS1
Operates at 130 ± 5°C
Recovery at 115 ± 7°C

ii) Bimetal OHS2
Operates at 90 ± 5°C
Recovery at 75 ± 7°C

iii) Thermal Fuse
Cuts out at 216 ± 2°C (one shot)

iv) Thermistor
Operates at 130 ~ 90^{O}C (High ~ Low).

Fan delay

The convection fan starts after a short delay to avoid cold draughts, and keeps running after burner extinction to allow the unit to cool down.

ON AT 15 sec, after ignition commences
OFF AT max. 210 sec, after combustion

Power failure circuit

Shuts off the solenoid valves if a power power failure occurs. The unit will relight after the power is restored, and the clock time will be slow by the amount of time the power was off.

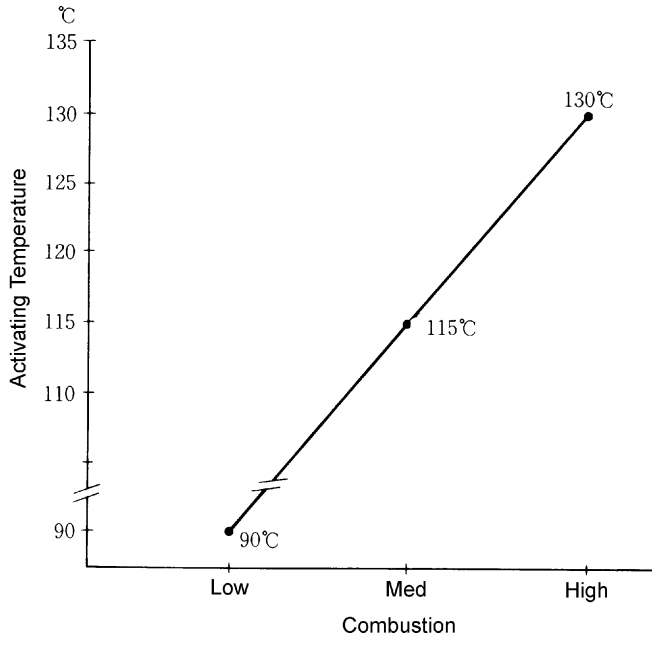
Thermistor Type Temperature Control

Controls room temperature within the range of 16~26^{O}C in 1^{O}C steps.

10. Overheat Control Method

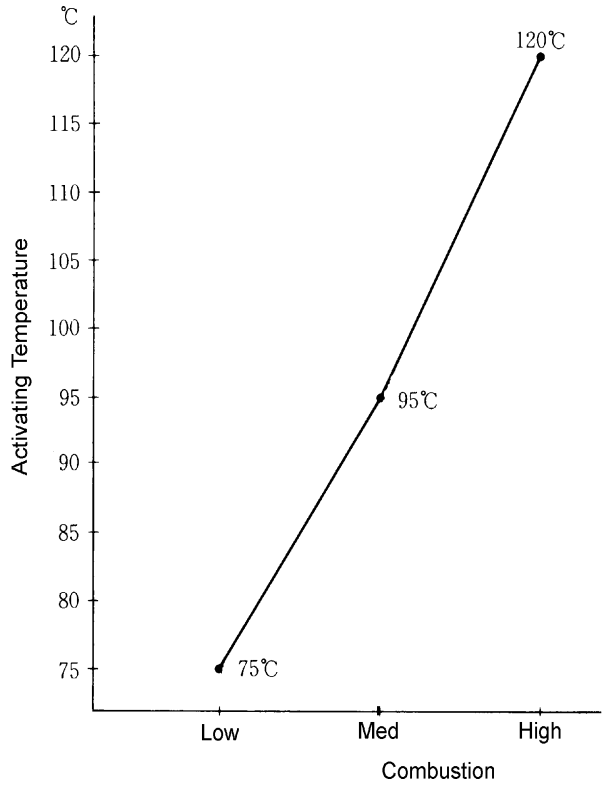
The overheat thermistor activates the overheat sensor and the filter indicator, as well as increasing the fan rpm.

(A) Overheat Sensor



The overheat thermistor activates at different temperatures for different gas rates (combustion).

(B) Filter Indicator

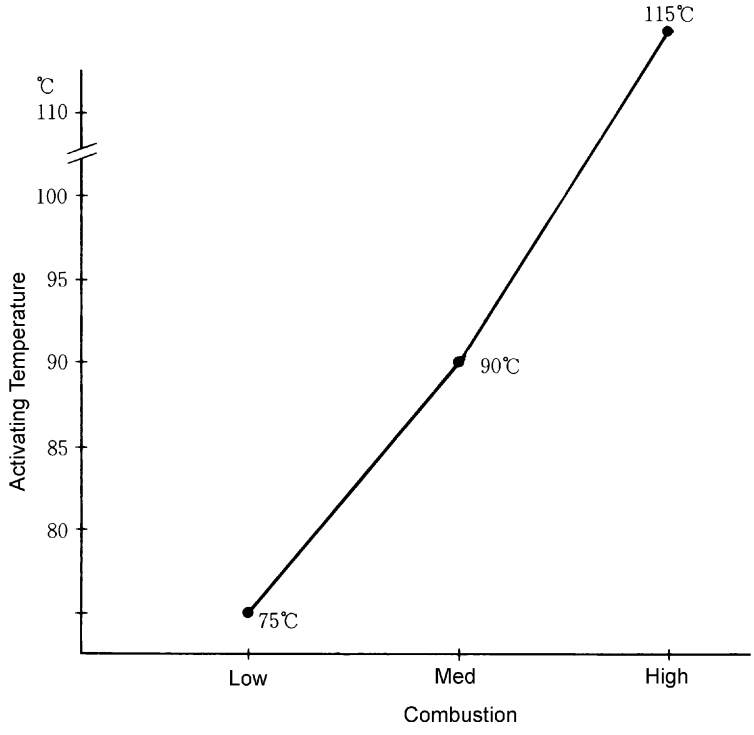


Note 1: Once the overheat limit temperature has been sensed and the filter indicator begins flashing, it will not go out, even if the temperature falls below the limit.

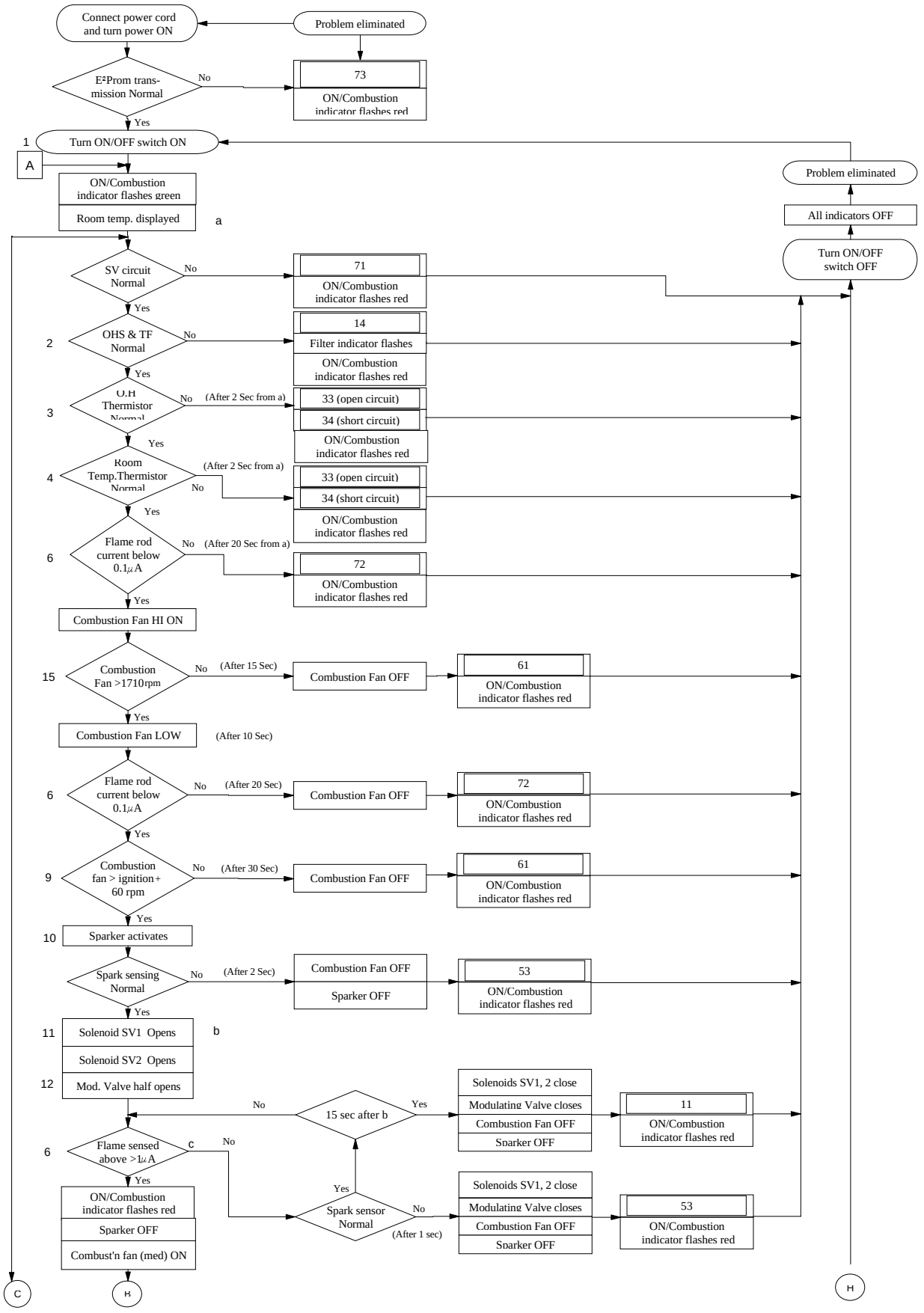
Note 2: Once the filter indicator begins flashing, gas input is limited to roughly 88% of high combustion.

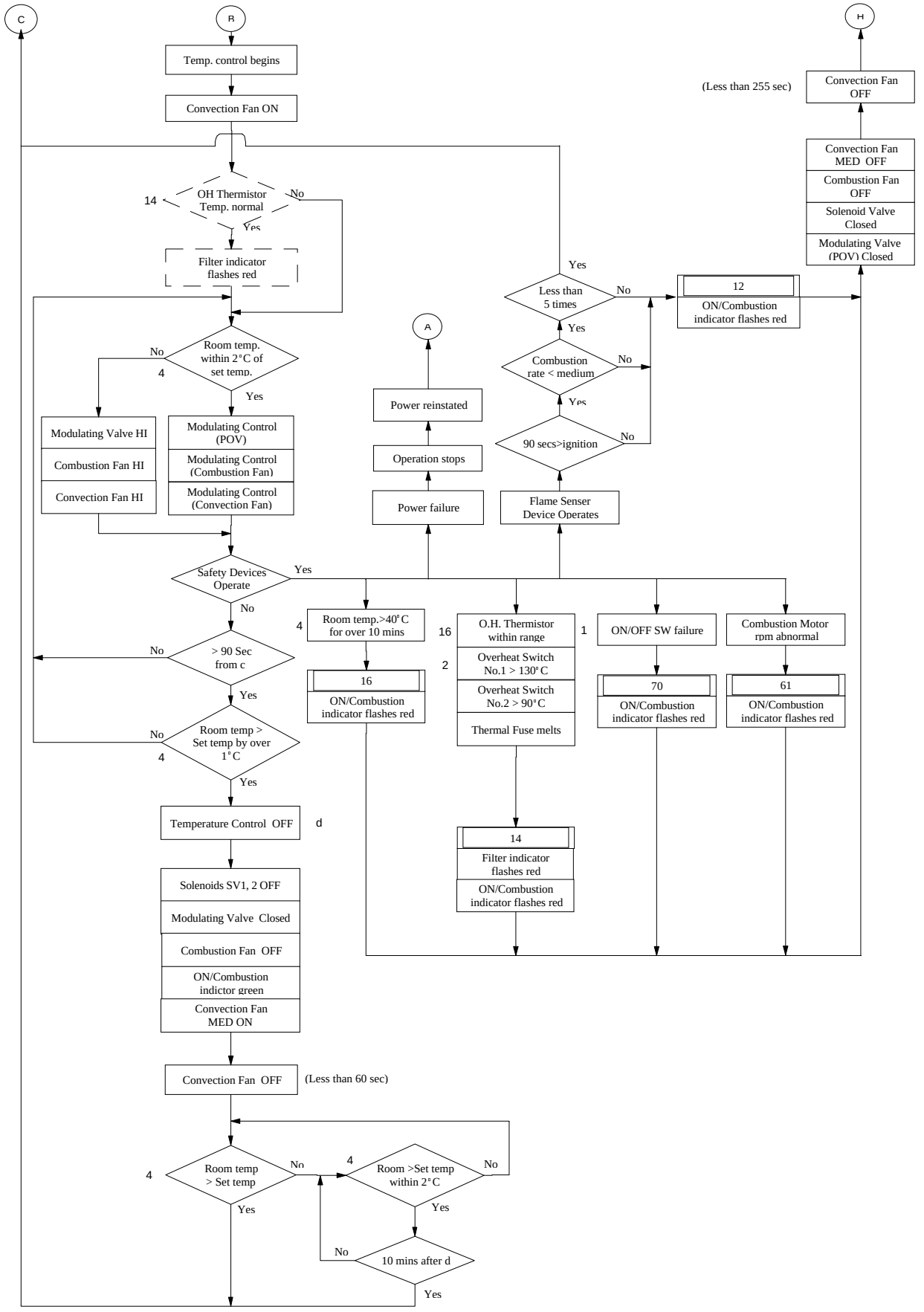
(C) Convection Fan RPM Increas

The fan rpm increases to compensate for a reduction in air flow due to a clogged air filter or other causes. The convection fan rpm is normally determined by combustion level. The speed increases by approximately 100 rpm at High.

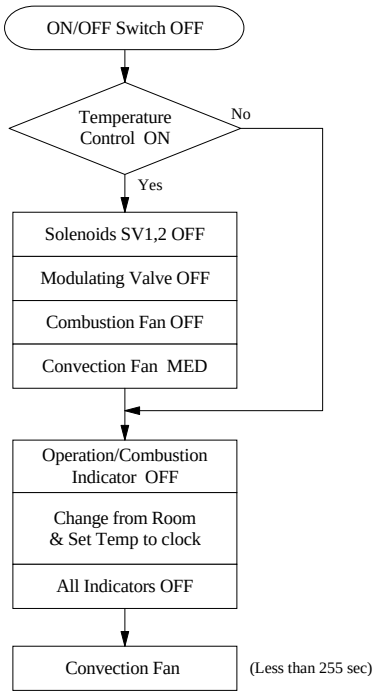


12. Operation Flow Chart

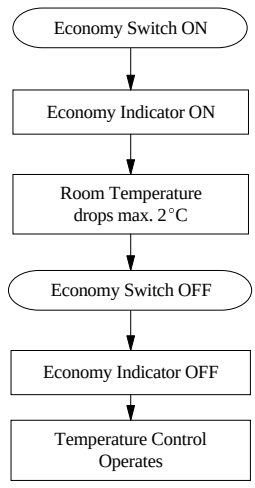



C
B
H
Temp. control begins
Convection Fan ON
14
OH Thermistor Temp. normal
No
Yes
Filter indicator flashes red
No
4
Room temp. within 2°C of set temp.
Yes
Modulating Valve HI
Combustion Fan HI
Convection Fan HI
Modulating Control (POV)
Modulating Control (Combustion Fan)
Modulating Control (Convection Fan)
Safety Devices Operate
Yes
No
No
> 90 Sec from c
Yes
No
4
Room temp > Set temp by over 1°C
Yes
Temperature Control OFF
d
Solenoids SV1, 2 OFF
Modulating Valve Closed
Combustion Fan OFF
ON/Combustion indictor green
Convection Fan MED ON
Convection Fan OFF
(Less than 60 sec)
4
Room temp > Set temp
No
Yes
4
Room >Set temp within 2°C
No
Yes
No
10 mins after d
Yes
A
Power reinstated
Operation stops
Power failure
Yes
Less than 5 times
No
Yes
Combustion rate < medium
No
Yes
90 secs>ignition
No
Flame Senser Device Operates
12
ON/Combustion indicator flashes red
(Less than 255 sec)
Convection Fan OFF
Convection Fan MED OFF
Combustion Fan OFF
Solenoid Valve Closed
Modulating Valve (POV) Closed
4
Room temp.>40°C for over 10 mins
16
ON/Combustion indicator flashes red
16
O.H. Thermistor within range
2
Overheat Switch No.1 > 130°C
Overheat Switch No.2 > 90°C
Thermal Fuse melts
1
ON/OFF SW failure
70
ON/Combustion indicator flashes red
Combustion Motor rpm abnormal
61
ON/Combustion indicator flashes red
14
Filter indicator flashes red
ON/Combustion indicator flashes red

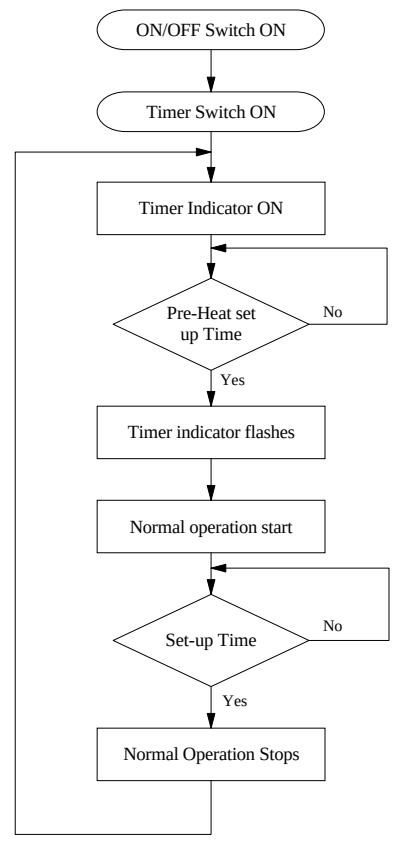
OFF



ECONOMY



TIMER OPERATION



13. Diagnostic Points

* "Flow" denotes references on the "Operation Flow Chart" on page 18.
* "CN" denotes connector number on the "Wiring Diagram" on page 22.

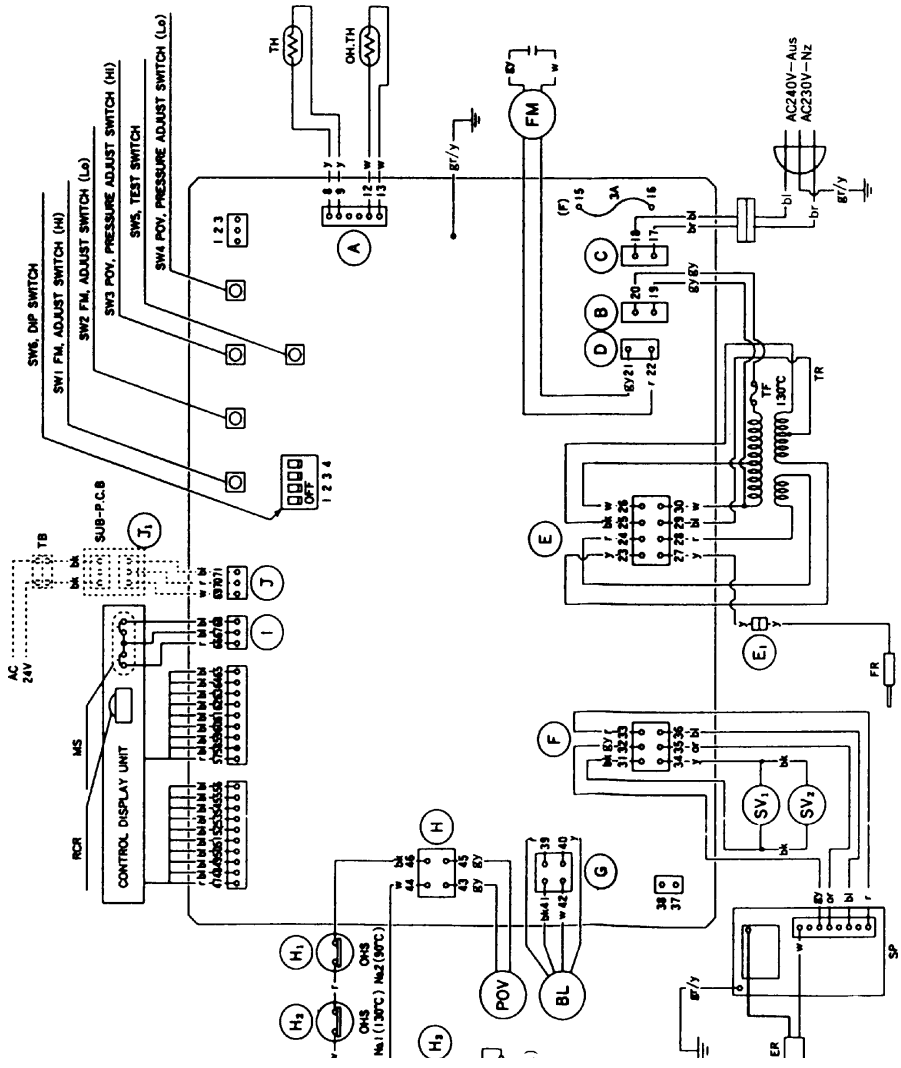
Flow	CN	Component	Wire Colour	Value (Normal)
1	I	ON-OFF Switch	red - blue	DC 3 ~ 10V, resistance 1 Ω (current flows when switched on)
			blue - blue	
2	H	Overheat Circuit	white - black	Less than DC 1 V; < 4 Ω (current flows)
	H1	Overheat SW 1	white - red	< DC 1 V < 1 Ω (current flows)
	H2	Overheat SW 2	red - black	
	H3	Thermal Fuse	white - white	
3	A	Overheat Thermistor	white - white	0.6 ~ 523 kΩ (< 0.6 kΩ: short, >523 kΩ: open
			temperature	20°C: 78 kΩ, 100°C: 3.6 kΩ, 150°C: 1.1 kΩ
4	A	Room Temp. Thermistor	yellow-yellow	1.8 ~ 844 kΩ (< 1.8 kΩ: short, >844 kΩ: open
			temperature	0°C: 123 kΩ, 20°C: 39 kΩ, 40°C: 14 kΩ
6	E1	Flame Rod	yellow-yellow	< DC 0.1 μA
7	G	Combustion Fan	red -black	DC 7 ~ 40 V; > 10 MΩ
			white - black	DC 1 ~ 4 V; > 3420 pulse/min (> 57 Hz
9	G	Combustion Fan	black - white	below ignition revolution + 120 rpm
			initial ignition	LP: 3480, NG: 3600 pulse/min
			re-ignition	LP: 3720, NG: 3780 pulse/min
10	F	Sparker	blue-red	AC 85 ~ 110 V
11	F	Solenoids 1 & 2	black - yellow	DC 78 ~ 100V, 1.3 ~ 2.2 k Ω
12	H	Modulating Valv	grey - grey	DC 1 ~ 15 V (low ~ high) 80 ~ 100 Ω
14	A	Over-heat Thermistor	white - white (filter indicator	high: flashes below 50 Hz; 2.2 kΩ
				low: flashes below 8.6 kΩ
15	G	Combustion Fan	white - black (normal rpm)	high: LP: 5760, NG: 5700 pulse/min
				low: LP: 3000, NG: 3240 pulse/min
16	A	Over-heat Thermistor	white - white (OHS on)	high: operates belo 1.7 kΩ
				low: operates below 5.3 kΩ
17	D	Convection Fan	grey - pink	AC 50 ~ 108 V (low ~ high), 90 ~ 180 Ω

Transformer Values

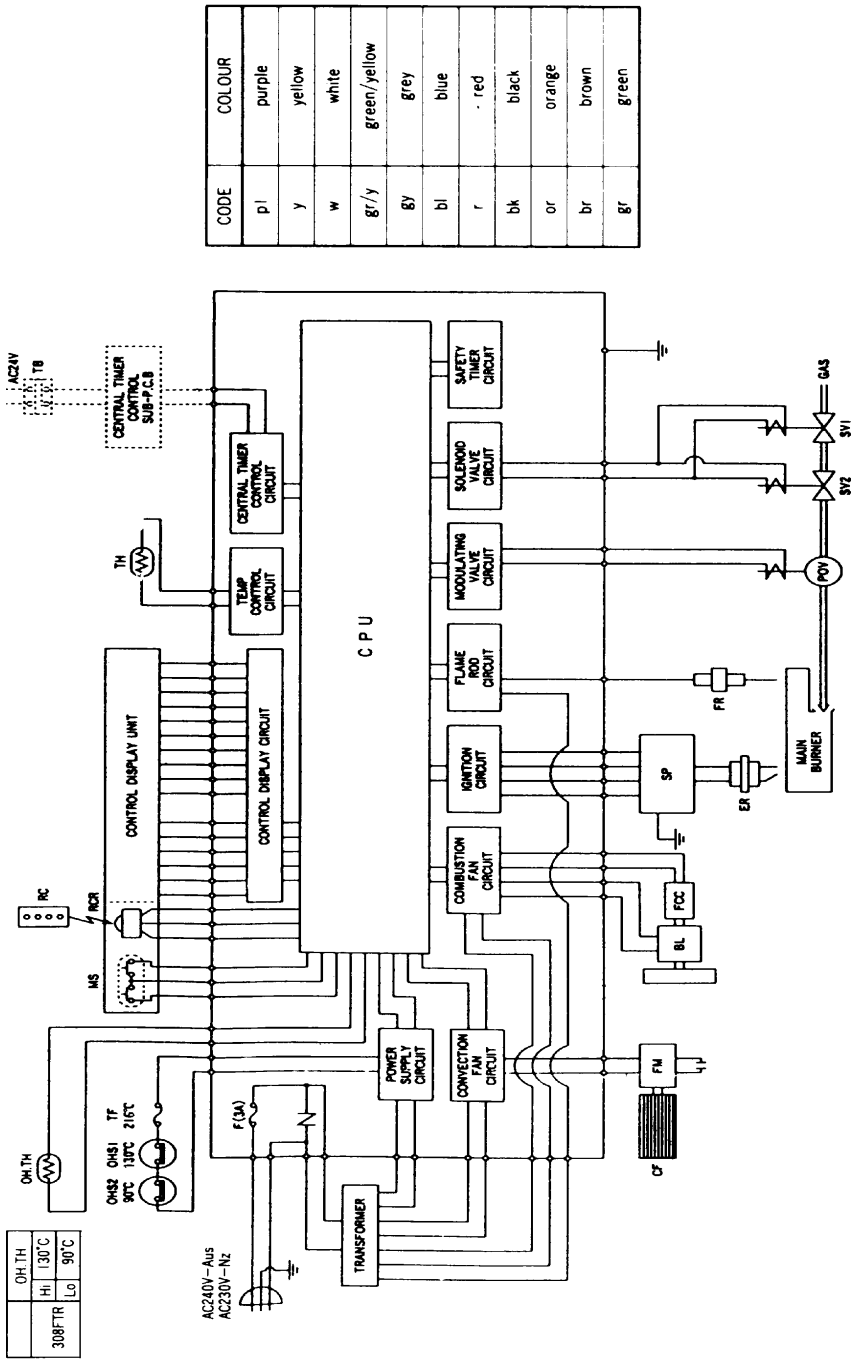
Wiring Diagram		Australia [240 V]	New Zealand [230 V]
E	Yellow - Blue	AC 130 ~ 180 V; 200 ~ 400 Ω	AC 130 ~ 180 V; 200 ~ 400 Ω
	Blue - Black	AC 10 ~ 16 V; 1 ~ 3 Ω	AC 10 ~ 16 V; 1 ~ 3 Ω
	Red - Red	AC 25 ~ 50 V; 1 ~ 3 Ω	AC 25 ~ 50 V; 1 ~ 3 Ω
B	Grey - Grey	AC 216 ~ 264	AC 207 ~ 253 V

14. Wiring Diagram

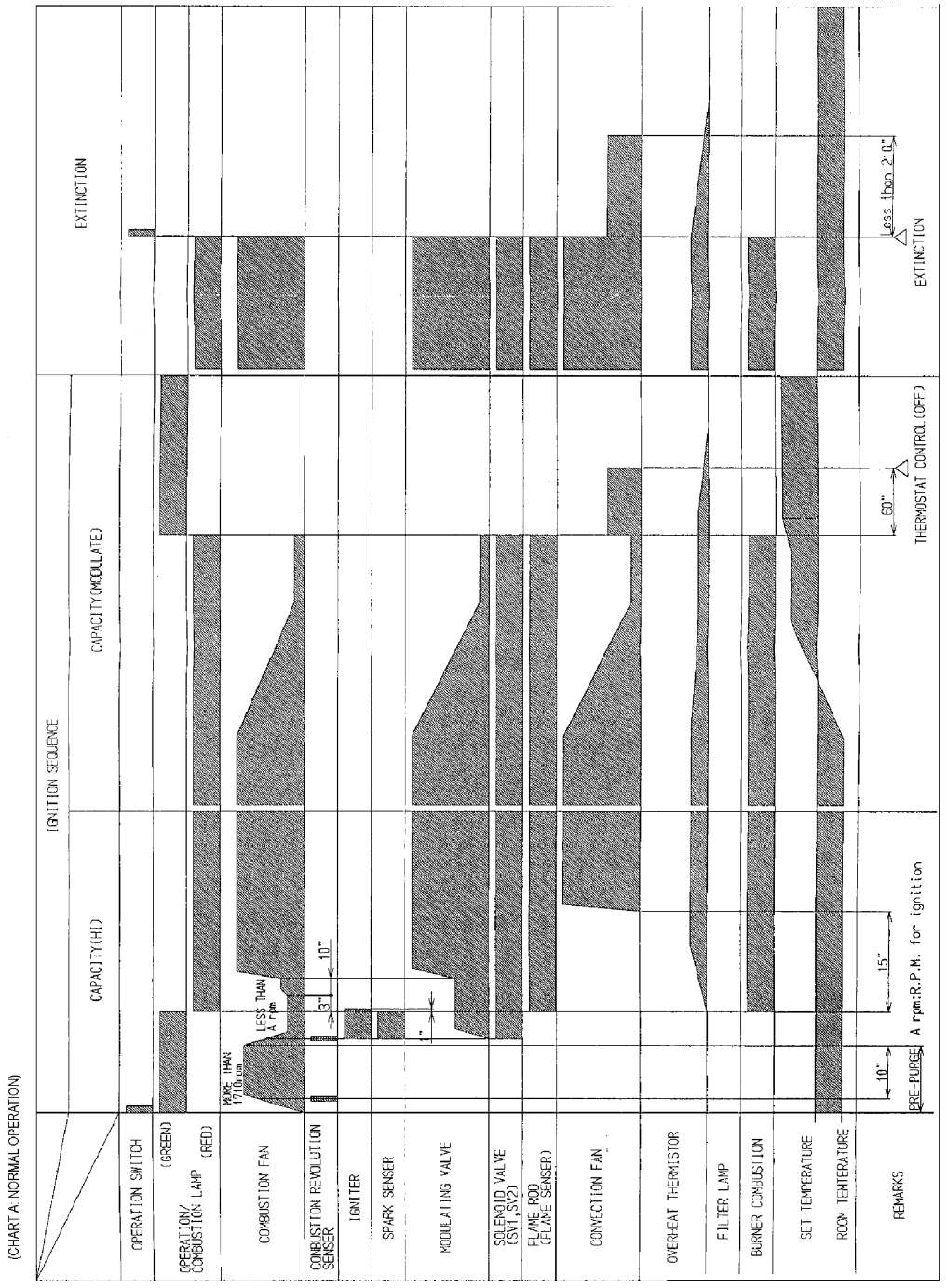
MARK	PART NAME
MS	MAIN SWITCH
TH	THERMISTOR
TF	THERMAL FUSE
F	FUSE
CF	CONVECTION FAN
FCC	FAN CONTROL CIRCUIT
ER	ELECTRODE
POV	MODULATING SOLENOID VALVE
TR	TRANSFORMER
RC	REMOTE CONTROL
TB	TERMINAL BLOCK
OH.TH	OVER HEAT THERMISTOR
OHS1~2	OVER HEAT SWITCH 1~2
FM	FAN MOTOR
BL	COMBUSTION FAN MOTOR
SP	SPARKER
FR	FLAME ROD
SV1~2	MAIN SOLENOID VALVE 1~2
CPU	CENTRAL PROCESSING UNIT
RCR	REMOTE CONTROL RECEIVER



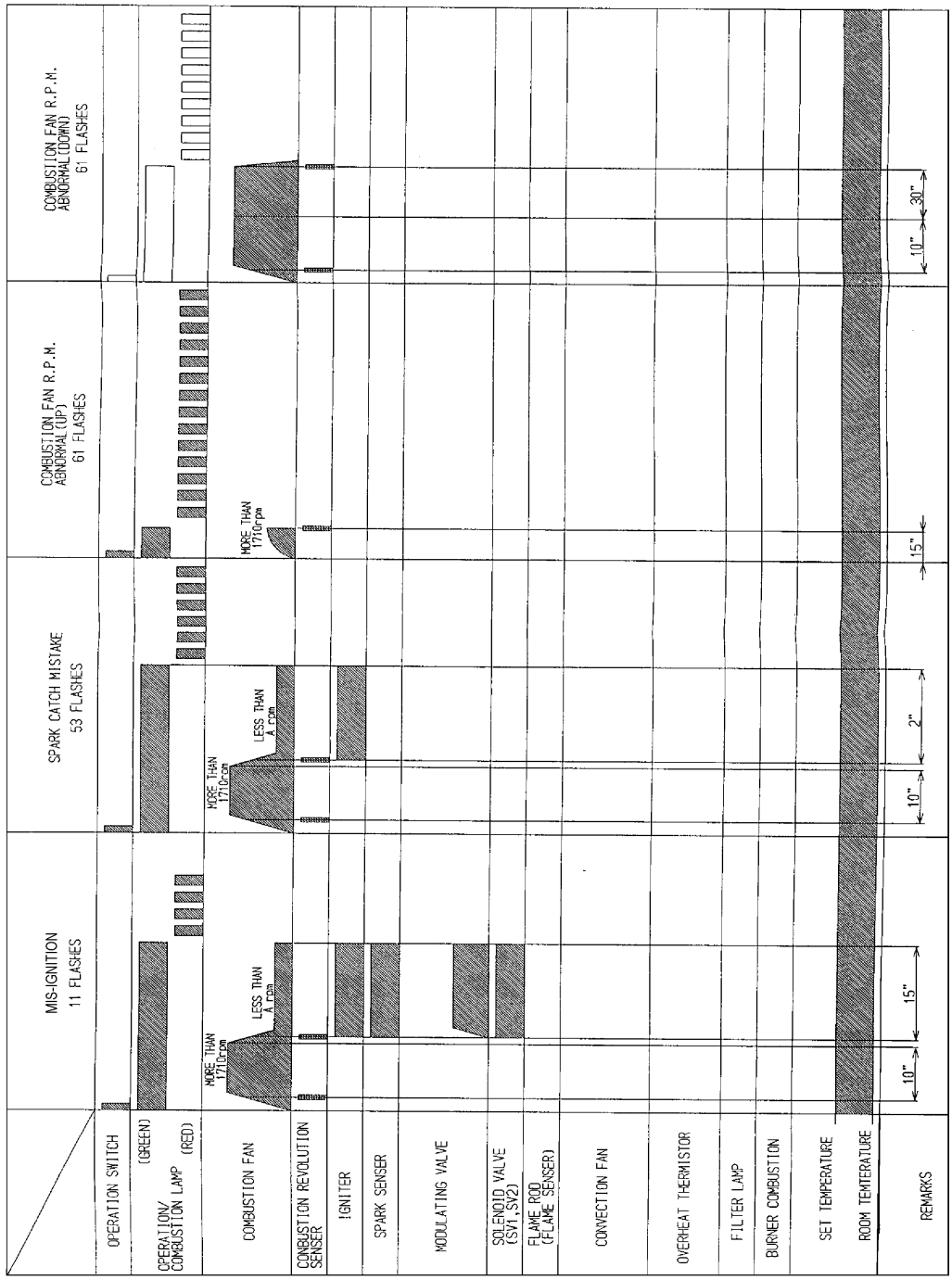
15. Block Diagram



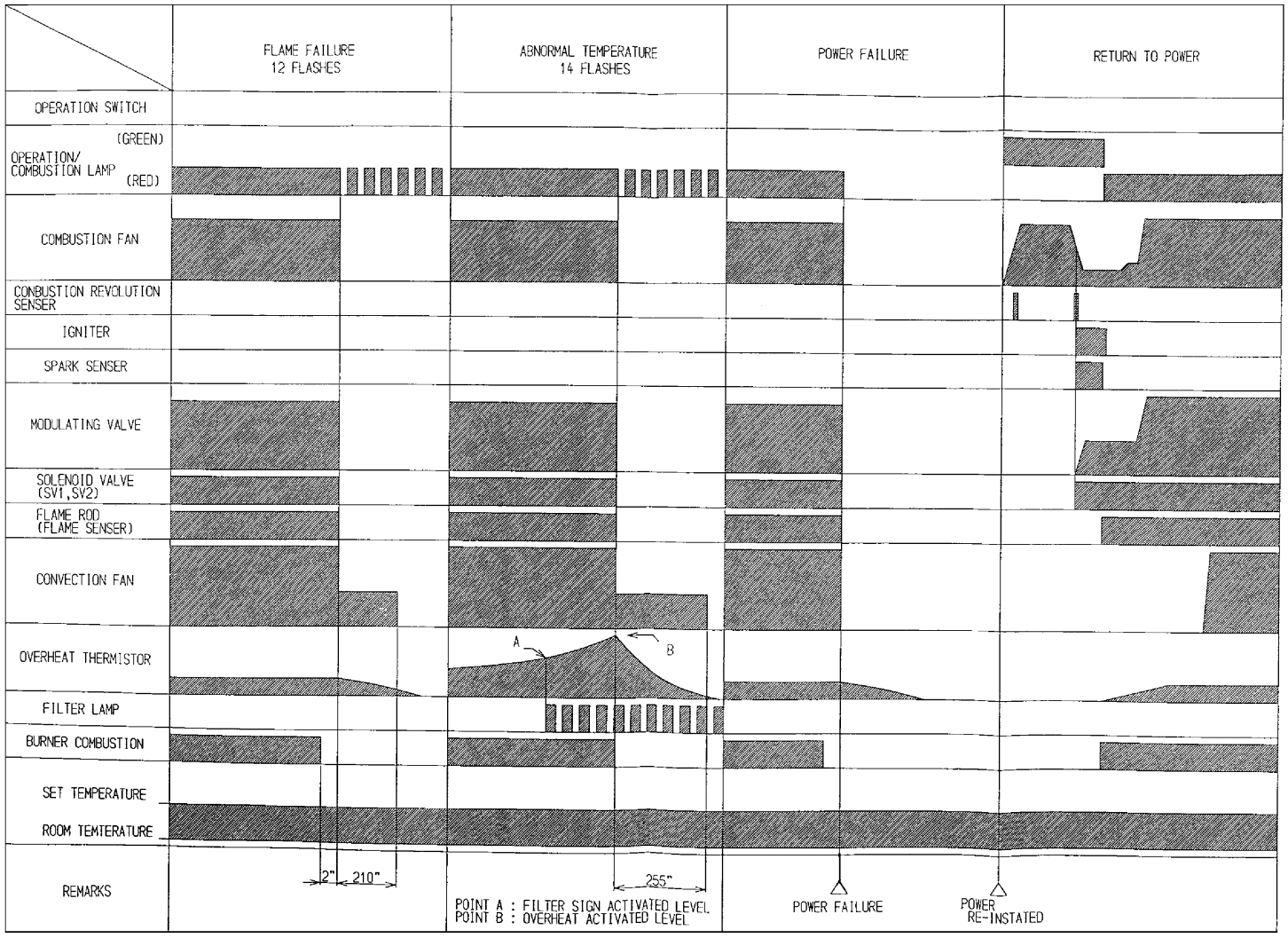
16. Time Charts



(CHART B: ABNORMAL OPERATION)



(CHART C: ABNORMAL OPERATION)



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17. E^2 PROM

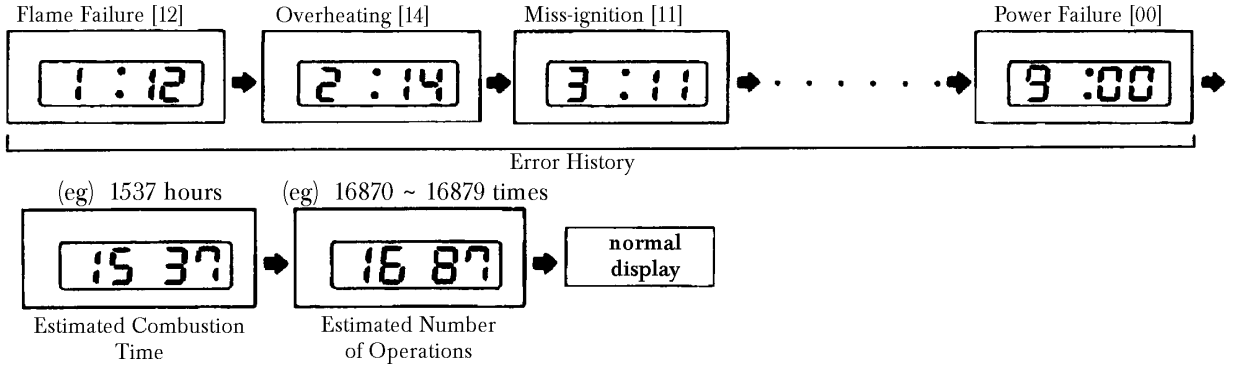
Memory Function for Error History, Estimated Combustion Time, and Estimated Number of Operations

E^2 PROM (Electrically Eraseable and Programmable Read Only Memory) is a ROM in which data is electronically programmed or erased. Programmed data will be stored semi-permanently even if the power fails or is disconnected.

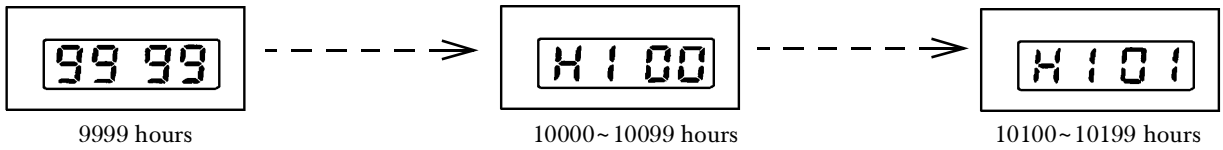
The most recent data on the past nine errors, estimated combustion time and estimated number of operations are included in the information stored in E^2 PROM.

- **How to Read the Data**
  Confirm the unit is off, press "/\", "\/" and "Economy" buttons at the same time for at least 2.5 seconds (a beep will be heard once). The data will be displayed on the LED display in the following order: Error Messages, Estimated Combustion Time, Estimated Number of Operations.

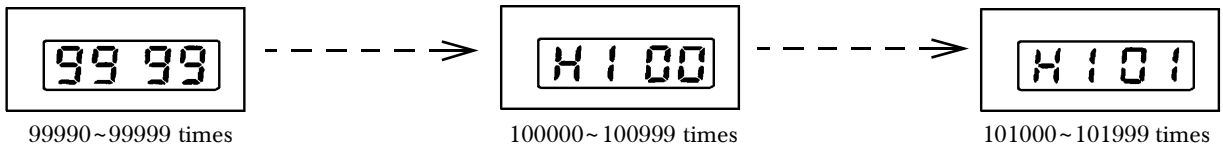
- **Data Display**
  The most recent error message (No. 1) will be displayed first, then it will be followed by up to eight previous errors (No. 2~9) displayed for 2 seconds each, as shown below. Following this, Estimated Combustion Time and Estimated Number of Operations data will be displayed for 4 seconds each as in the example below (No error messages "-- . --" will be displayed if no errors were recorded).



Estimated Combustion Time will be displayed as below if between 0 ~ 9,999 hours. However, if it is more than 10,000 hours, then "H" is added to the beginning of the display. Hours will be rounded up to the nearest 100 as shown below.



Estimated Number of Operations will be displayed as below (1=10 times) if between 10 ~ 99,999 times. However, if it is more than 100,000 times, then "H" is added to the beginning of the display. Operations will be rounded up to the nearest 1000.



***Note:** Estimated Number of Operations is the number of ON-OFF movements on the solenoid valve.

- **Deleting Data from E^2 PROM**
  Confirm the unit is turned off, and press "/\", "\/", "Economy" and "Lock" buttons at the same time for at least 1 second. (Lock beep will be heard once and another beep wil be heard a second later).
  Digital display turns off and displays "- - : - -" when the data is deleted completely. However, the data on Estimated Combustion Time and Estimated Number of Operations cannot be deleted.
  Once recorded in E^2 PROM, the data is protected from power failures.

Permanent Data	Deletable Data** (initial settings)
• Modulating Valve Supplement CurrentValue (HIGH) • Modulating Valve Supplement CurrentValue (LOW) • Convection Fan Supplement CurrentValue (HIGH) • Convection Fan Supplement CurrentValue (LOW) • Estimated Combustion Time • Estimated Number of Operations	• Error History (none) • Clock (12:00 am) • Economy Operation (OFF) • Lock (OFF) • Preset RoomTemperature (22 °C) • ON Timer (06:00 am)

** *This data can be deleted as described above.*

18. Error Coded Messages

Error is displayed as a number on clock flashing. (Filter indicator will also flash in the case of overheat.)

Error Code	Probable Cause	Comments	Ref †
--:--	Power failure	When power failure is sensed operation stops.	-
11	Miss ignition	Flame current does not reach 0.1μA within the given time, after solenoid valve opens.	6
12	Flame failure	Flame rod current remains below 0.1 μA for 3 seconds during initial combustion.	6
14	Over heat safety device	High-limit temperature thermistor or thermal fuse has activated.	2
16	Over temperature cut off	Room temperature is sensed as being above 40°C for longer than 10 minutes.	4
31	Room temperature thermistor disconnection	Room temperature thermistor open circuit	4
32	Room temperature thermistor short circuit	Room temperature thermistor wire trapped, touching bare metal	4
33	High-limit thermistor disconnection	High limit thermistor open circuit for over 2 seconds	3
34	High-limit thermistor short circuit	High limit thermistor short for over 2 seconds	3
53	Abnormal spark sensed	Sparker not OFF within 20 seconds at time of ignition	-
		1st spark sensed not within 2 seconds	
		2nd spark sensed spark not continuous for 1 second after solenoid valve opens	
61	Abnormal combustion fan motor rpm	Speed is not achieved within time or goes over speed level	15
70	ON/OFF switch failure	ON/OFF switch on continuously for more than 15 seconds	1
71	Solenoid valve check	Solenoid valve(s) (SV_1, SV_2) signal and response signal are different.	11
72	Flame rod failure	Flame rod current should not go below 0.1μA within 20 seconds of starting.	6
73	Communication failure	Data transfer between CPU and E^2PROM fails.	-

† Refers to the number on the operational flow chart, page 18, and diagnostic points, page 21.

* To reset error codes, press the ON switch while the error code is showing. This will not reset error codes “71" and “73"; power needs to be reset to erase these codes.

19. Fault Finding

Main Faults and their Remedies

* Numbers on the right hand side of this table refer to “Causes of Faults and Suggested Remedies” on pa ge31.

Fault Symptom	Error Codes	Check Points / Remedy
The Economy indicator will not come ON.		* Confirm that Economy Mode has been selected * Confirm electrical cord is securely into the power point
After having pressed the ON - OFF switch the appliance will not operate.	**11**	* Check gas supply . . . . . **1** * Confirm no gas escapes . . . . . **1** * Check for air in the gas supply . . . . . **1** * Reconfirm gas type specified **1**
Insufficient heating.		* Check selected room temperature setting . . . . . **2** * Check for blocked air filter . . . . . **3** * Check for an obstruction in the warm air flow . . . . **4** * Reconfirm gas pressure at appliance **1**
Burner goes out during operation.	**12** **14** **16**	* Ensure flue terminal is not blocked . . . . . **5** * Ensure air filter is not blocked . . . . . **3** * Power Failure . . . . . **8** * Check for an obstruction in the warm air flow . . . . **4** * Reconfirm gas type specified * Confirm no gas escapes . . . . . **1** * Check for flash back . . . . . **6** * Check for high room temperature . . . . . **7** * Reconfirm electrical supply at power point **8**
Gas odour.		* Confirm no gas escapes (at connection) . . . . . **1** * Product of combustion leak **9**
Power failure.	**--:--**	* Power failure (> 0.2 seconds **8**

† Error is displayed as room temperature LEDs flashing

Causes of Faults and Suggested Remedies

1. Gas supply

In cases of miss ignition, insufficient heating and gas smell, check that:

- The gas supply pressure is correct.
- The specified gas type is correct for the area.
- There are no breaks/escapes in gas supply.
- There is no air in the gas supply.

⇒ Check the gas pressure at both the meter and the appliance.

⇒ Air in the gas line will prevent the appliance from igniting.

2. Thermostat setting

When the room does not reach the selected temperature, or the appliance will not remain alight, check that:

- The selected temperature is not set lower than the room temperature.

⇒ Select the required temperature setting with the UP/ DOWN selection buttons.

3. Blocked air filter

If insufficient heating or lockout occurs, check that:

- The air filter is not blocked with dust.

⇒ If the air filter is blocked, the safety device will operate.
..... 14 flashing

⇒ The filter must be cleaned at least once per month.

4. Air flow obstruction

If insufficient heating or lockout occurred, check that:

- There are no obstacles in front of the appliance or louvres.

..... 14 flashing

⇒ There should be no articles within one (1) metre of the front of the appliance.

5. Flue terminal

If flame failure occurs during normal operation, check that:

- The flue terminal on the exterior wall is not obstructed in any way.

..... 12 flashing

⇒ Check in particular for shrubs growing over the flue terminal or a thick build up of spider webs.

6. Flash back protection

If flame failure occurs during normal operation, check:

- The flue terminal air intake is not blocked.
- For dust or foreign material on the burner.
- Combustion specification and gas type.

..... 12 flashing

7. Room temperature

- Is the room temperature unusually high?

⇒ 10 minutes after having sensed 40°C the appliance will automatically go out.
..... 16 flashing

8. Power failure

- If there has been a power failure for 0.2 seconds or longer. Current time will be displayed on display when “set times” button is pressed once. (Time will be slow by duration of power failure).

..... --:-- flashing

9. Smell of products of combustion

If there is a smell of gas or products of combustion, check that:

- The flue manifold behind appliance has not come undone.

⇒ The products of combustion are leaving the appliance through the flue terminal.

Before contacting Rinnai, please check the following points. These points are part of the normal operation of the unit.

At Ignition

Heater does not operate.	→	Is the heater plugged in? Is there a power failure? Have the fuse or breaker blown at the switchboard? Are the air filter, flue, or warm air outlet blocked? Are Timers set? Clear Timers and operate again. Is the central timer on? (where fitted)
Warm air does not flow when the burner lights.	→	The fan is started automatically after a short delay. This is to allow the heat exchanger to warm up.
Smoke or strange smells are produced on the first trial light up after installation.	→	This is caused by grease or oil and dust on the heat exchanger and will stop after a short time.
Sharp clicking noises at ignition, or when the unit cuts down on the thermostat, or goes out.	→	This is simply expansion noise from the heat exchanger.

During Combustion

Clunking noise when the thermostat operates.	→	This is the sound of the solenoid gas valves.
Unit is not heating room?	→	Is the air filter or warm air outlet blocked? Is the set temperature high enough? Are the doors and windows of the room closed?
Air filter or louvres are blocked or obstructed.	→	Allow heater to cool, clean air filter, operate again.
Heater will not reignite after overheating.	→	Heater does not reignite. Repair is necessary.

When the Unit is Turned Off

Convection fan continues to run after turning off.	→	This is to remove the residual heat from the heat exchanger, the fan will stop when the heater cools down.

Other Points

Steam is discharged from the flue terminal.	→	High efficiency appliances tend to discharge water vapour on cold days, this is normal.
Unit cuts off without apparent reason.	→	Check is central timer is switched off (where fitted), or whether filters are blocked, (dirty filters will cause the heater to overheat).
Power failure.	→	When power is restored, the appliance will begin to heat if it was on at the time of power failure. Clock will be delayed by the length of the power failure.
Remote control does not operate.	→	Check battery. Try moving closer to the heater.

20. Fault Analysis

A. ***After having operated the appliance and:***

i) The combustion fan doesn't begin to rotate, or suddenly stops after running for a short time.
ii) There is no spark (after 30 seconds).
iii) The solenoids do not open, preventing gas flow to the burners.
iv) The convection fan does not begin to rotate, approximately 15 seconds after ignition.

Is there electrical supply ⟶ NO ⟶ 1. Confirm the connection at the wall socket
2. Is the 3 amp fuse blown?

↓
YES
↓

a. The appliance does not operate.

i) Open circuit or loose pin connector on PCB or wiring loom.
ii) ON/OFF button faulty. ... **70 flashing**
iii) Faulty Printed Circuit Board.
iv) Control panel PCB faulty.
v) OHS is 'OPEN'. ('CLOSED'⟶ Normal) ... **14 and filter indicator flashing**
vi) Thermal fuse has melted.
vii) Solenoid circuit is faulty. .... **71 flashing**

↓

b. The combustion fan doesn't rotate, or the appliance fails after a short time.

i) Combustion fan shaft allen screw loose.
ii) An obstruction in the combustion fan is preventing it from rotating.
iii) Combustion fan does not go over1710 rpm. ... **61 flashing**
iv) The flame rod current is greater than 0.1 μA during pre-purge.... **72 flashing**
v) The combustion fan rpm not below ignition rpm + 60. ... **61 flashing**
vi) Faulty spark generator. ... **53 flashing**
vii) Faulty PCB.

↓

c. There is no spark.

i) High tension cord disconnected or broken.
ii) Insulation leak from the high tension cord, (Spark sound is not regular).
iii) The spark gap is not correct (normal spark gap is 3.5 ± 0.5 mm).
iv) Weak or shorting spark.
v) Faulty PCB.

d. The solenoids do not open, preventing gas flow to the burners.

i) Open circuit or loose pin connectors on PCB or wiring loom.
ii) Faulty solenoid, or coil.
iii) Faulty sparker, (no spark is sensed).
iv) Faulty PCB (no current to SV).

e. The convection fan doesn't rotate.

i) Convection fan shaft allen screw loose.
ii) An obstruction in the convection fan is preventing it from rotating.
iii) Flame rod faulty.
iv) Faulty PCB.

B. After repeated efforts to operate the appliance, it will not ignite. ... ***11 flashing***

i) Air in the gas supply line.
ii) Incorrect gas pressure.
iii) Incorrect gas type, or a kink or break in the gas supply.
iv) Faulty or weak spark.
v) Blocked injector. Is the combustion specification correct?

C. There is the sound of ignition, however the 'combustion' injector does not glow red.

After 15 seconds the spark stops and mis-ignition occurs.

Miss-ignition

Ignition OK

Confirm the flame rod current.

1. Faulty indicator/incorrect wiring.
2. Faulty PCB.

Has the current risen above 1.0 μA.

No

1. Check combustion specification, gas type, and gas pressure.
2. Check the combustion condition.
3. Check flame rod is firmly positioned.
4. Check the flame rod lead.

Yes

Faulty PCB

D. The flame fails during normal operation.

1. Power failure for 0.2 seconds or longer. ... **"_ _ : _ _" flashing when power reinstated**
2. Safety devices are activated.

* Room temperature is sensed at above 40°C for 10 minutes. ... **16 flashing**
* Air filter is blocked and the OHS is activated. ... **14 and filter indicator flashing**
* Obstruction in the flue terminal. ... **12 flashing**
* Blockage or insufficient gas supply. ... **12 flashing**
  * Gas pressure is abnormally low.
  * The area surrounding the flue terminal may be restricted.
* Obstruction in front of the heater. ... **14 and filter indicator flashing**

↓

3. Safety Devices activated no fault evident.

Have you ensured that the connectors are in the correct positions, and also the wiring is not disconnected anywhere?

Flame failure 30~60 mins after ignition. "12" flashing.

↓

Is flame rod current > 1.0 μA?

Yes ↓

Faulty PCB.

No ↓

1. Confirm specification of regulator, restrictor, injector, etc..
2. Check condition of flame rod and burner.

4. Flame failure (makes a loud noise).

↓

1. Blocked flue terminal).
2. Dust in the burner terminal
3. Incorrect gas type or pressure setting

5. Flame faillure occurs between 2 and 3 minutes after ignition. "12" flshing.

↓

Is flame rod current greater than 1.0 μA?

No → *Is the gas pressure normal?
*Is the flame rod faulty?

Yes ↓

Combustion fan motor control may be faulty

↓

PCB faulty

21. Electrical Component Analysis

* Before starting inspection, check wiring harness and double check that all connectors are tight.
* Before carrying out checks marked *, remove power cord from wall socket.

Nature of Fault	Examination Point	Diagnostic Point	Values	Y/N	Action
A. "12:00" fails to flash when power cord is pugged in, and temperature is not displayed when unit is turnedon (normal sequence can not proceed).	1) Is the voltage correct?	Check electric socket and voltage.	AC 230 - 240 V	Yes	Go to (2).
				No	Repair electric source.
	((2) Blown or defective fuse?	1. Measure fuse resistance.	< 1 Ω	Yes	Go to (3).
				No	Replace fuse. Go to (2) - 2.
		*2. Measure convection motor coil resistance after removing 2P connector.	(D) Grey - Pink 90 - 180 Ω	Yes	Go to (2) - 3.
				No	Replace convection motor.
		*3. Measure combustion motor coil resistance after removing 4 connector.	(G) Red - Black > 1 M Ω	Yes	Go to (2) - 4.
				No	Replace combustion motor.
		*4. Measure resistance of transformer after removing 8P connector.	(E) White - White 5-20 Ω. (E) Red - Red 1 - 8 Ω. (E) Black - Blue 0.5 - 3Ω (E) Blue - Yellow 250-450 Ω.	Yes	Go to (2) - 5.
				No	Replace transformer.
		*5. Remove solenoid valve lead wires (SV_1, SV_2) and measure coil resistance between terminals.	(F) Black - Yellow SV_1 1.3-2.2KΩ SV_2 1.3-2.2KΩ.	Yes	Go to (2) - 6.
				No	Replace solenoid valve.
		*6. Remove modulating valve lead wire(s) (POV) and measure coil resistance between terminals.	(H) Grey - Grey 80 - 100 Ω	Yes	Replace PCB.
				No	Replace modulating valve.
	(3) Is the transformer OK?	Check transformer secondary voltage.	(E) Red - Red AC 24 - 41V (E) Black-Yellow AC 10 -17V (E) Blue-Yellow AC 130 - 180 V	Yes	Replace PCB.
				No	Replace transformer.

B. Error code appears soon after turning heater on (normal sequence cannot proceed).	(4) Is overheat switch 1 or 2 OFF? (... 14 flashing) If unit over heated, it will turn back ON once the unit cools down.	* With ON/OFF switch OFF, check continuity between both terminals.	(H1) White-Red < 1 Ω (H2) Black - Red < 1 Ω	Yes	Go to (6).
				No	Replace overheat switch 1 and/or 2.
	(5) Overheat thermistor broken/short circuit? (broken...33 flashes (short...34 flashes)	* Measure resistance between unit and thermistor (Differs according to temperature)	(A) White-White 20^{o}C 78 kΩ 100^{o}C 3.6 kΩ	Yes	Replace PCB
				No	Replace thermistor
	(6) Has the thermal fuse melted? (... 14 flashing)	* With ON/OFF switch OFF, check continuity between both terminals.	(H_3) White-White 0 Ω	Yes	Replace PCB.
				No	Replace temperature fuse.
	(7) Is the combustion motor wiring OK? (... 61 flashing)	* Check combustion motor coil resistance using same procedure as (2)-3 above.	Red - Yellow >1 M Ω	Yes	Go to (9).
				No	Replace combustion motor.
C. No spark	(8) Is there any spark leakage due to loose or disconnected high tension lead	Check connection visually and by hand.	Good connection and no leakage.	Yes	Go to (10).
				No	Connect properly.
	(9) Is the spark unit voltage low?	Measure sparker input voltage.	(F) Blue - Red AC 85 - 110 V	Yes	Replace sparker.
				No	Replace PCB.
D. Spark fails to produce ignition (stops after approx. 15 sec.) (... 11 flashing)	(10) Are the solenoid valves (SV_1, SV_2) ON?	*1. Check solenoid valve coil resistance using same procedure as (2)-5 above.	(F) Black - Yellow SV_1 1.3 - 2.2 k Ω SV_2 1.3 - 2.2 k Ω	Yes	Go to (11) - 2.
				No	Replace solenoid valve.
		2. Check solenoid valves terminal voltage.	(F) Black - Yellow DC 78 - 100 V	Yes	Go to (12).
				No	Replace PCB.
	(11) Is the modulating valve (POV) OK?	1. Check test point pressure. (Modulating valve P_2)	Is it at the specified pressure?	Yes	Check injector / damper.
				No	Go to (12) - 2.
		2. Check position of SW6 switches on PCB.	Refer to (Gas changeover switch)	Yes	Go to (12) - 3.
				No	Set to proper position
		*3. Check modulating valve coil resistance.	(H) Grey - Grey 80 - 100 Ω	Yes	Adjust regulator pressure. If it does no match, replace PCB.
				No	Replace modulating valve.
E. Ignition occurs, but combustion indicator does not operate. (Sparker stops after approx. 15 sec) (... 11 flashing)	(12) Is the modulating valve OK?	Measure test point pressure as in (12)-1 $_2$ above.	Is it at the preset pressure?	Yes	Go to (14) after checking injector and damper.
				No	Adjust regulator pressure.
	(13) Is the current of the flame rod (FR) circuit >1.0 µA .	* Check flame rod circuit current. (Disconnect, measure between connector and lead.)	(E1) Yellow - Yellow flame rod >1.0 μA.	Yes	Replace PCB.
				No	Replace flame rod.

F. Heater does not reach preset room temperature.	(14) Is the thermistor OK?	* Disconnect thermistor from unit and measure resistance between terminals. As there may be some variance due to temperature setting, use the chart at the right as a guide.	(A) Yellow - Yellow 0^oC : 123 kΩ 20^oC : 39 kΩ	Yes	Replace PCB.
				No	Replace thermistor.
G. Heater stops during use (turns off prematurely: broken indicator motor).	(15) Shut off mechanism activated. (... 12 flashing)	Check flame rod circuit current.	(E1) Yellow - flame rod > 1.0 μA. (Disconnect, measure between connector and lead.)	Yes	Check for dust, FR wire and connector.
				No	Replace PCB
	(16) OFF function activated. (... 16 flashing)	Was the heater used for a long period at a high temperature?	Over ten minutes at above 40^oC.	Yes	Explain usage.
				No	Replace PCB.
	(17) Overheat switch activated. (... 14 flashing)	1. Check for dust on air filter, convection fan and air outlet.	Is the dust build up extreme?	Yes	Clean.
				No	Go to (18) - 2.
		2. Check combustion specifications	Correct?	Yes	Go to (18) - 3.
				No	Adjust accordingly
		3. Is the convection fa revolution speed correct? Measure motor coil resistance. See (2)-2.	(D) Grey - Pink 90 - 180 Ω	Yes	Go to (18) - 4.
				No	Replace motor.
		4. Check voltage at 2P terminal D on PCB (convection fan) .	HIGH - LOW AC 50 - 108 V	Yes	Check fan lock / obstruction, spin, etc.
				No	Replace PCB.
H. All other problems.	Are there any loose or defective connections?			Yes	Repair

Note: If a problem is not remedied by replacing the appropriate part, the wiring harness is defective (short circuit, open circuit and/or defective connectors). Check for any short or open circuit. Lightly wiggle wires and harness to check for loose or faulty connectors.

22. Testing

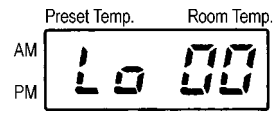
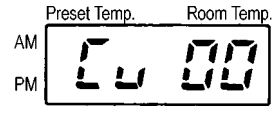
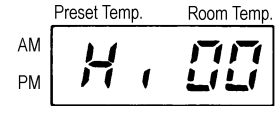
Test Mode Summary

Test Mode 1 - This mode cancels temperature control, and starts combustion mode.

Test Mode 2 - This mode controls the modulating valve and convection fan (Normally, this test mode is used when converting gas type and changing the PCB).

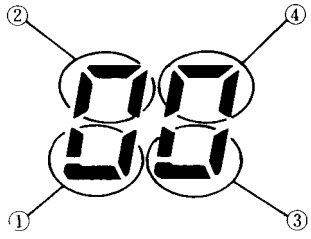
* Operating Procedures and Indicator

(A) Test Mode 1

Operating Procedures	Illuminated Indicators
1. Turn the appliance on (combustion indicator illuminates). Press test mode switch (SW 5) at top of the PCB (combustion mode changes to "Low" test mode).	LOW 
2. Change combustion and convection fan mode using the Temperature/Time setting switch located on the control panel. The mode changes from LOW → MED → HIGH each time the "/\" switch is pressed. The mode changes HIGH → MED → LOW each time the "\/" switch is pressed.	MEDIUM  HIGH 
3. Return operation to normal by pressing the test mode switch (SW 5) again.	Displays temperature.

Note: Indicators (digital display "00" and "22", "24", "26" and "HIGH" indicators) show that modulating valve and/or convection fan adjustment is complete.

Digital Display



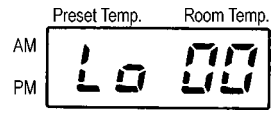
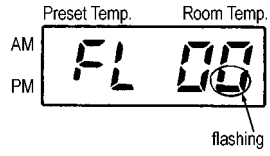
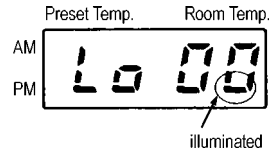
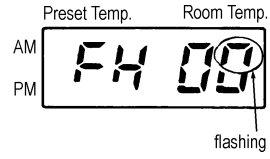
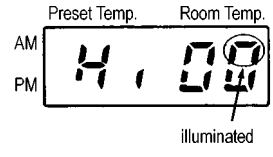
Sections of the digital display show that the following adjustments have been completed:
1) Modulating Valve (LOW)
2) Modulating Valve (HIGH)
3) Convection Fan (LOW)
4) Convection Fan (HIGH)

The indicators will be off when the PCB unit is replaced.
Indicators will illuminate after test mode 2 adjustment is completed.

2. Indicators (digital display "LO", "Cu", "Hi" and "LO", "16", "18", "20" indicators) may be flashing at times. This means the combustion mode is in transition (eg. Changing from LOW→ MED). The indicators will glow steadily once combustion mode stabilises.

(B) Test Mode 2 (Adjusting Modulating Valve)
See "Gas Pressure Setting Procedure" on pag e43.

(C) **Test Mode 2** (Adjusting Convection Fan rpm)
Convection fan rpm is prerecorded in the PCB unit software. Therefore, adjustment is not required when the PCB unit is replaced.

Operating Procedure	Indicators
1. Turn the appliance on (combustion indicator illuminates). Press test mode switch (SW 5) at the top of the PCB (combustion mode changes to "LO" Test mode).	
2. Press convection fan adjusting switch LO (SW). Sections of the indicators will flash to show that adjustment is in progress. 3. Adjust by using the Temperature/Time setting SW located above the control panel. "/\" SW increases and "\/" decreases the rpm.	
4. Once the adjustment is complete, press SW2 again. Low current supplement value is recorded in E^2PROM and will be confirmed. Indicators will stop flashing and will glow steadily.	
5. Press convection fan adjustment SW HI (SW1) located at top of PCB unit. (Combustion mode changes to "HI" test mode) 6. Adjust by using the Temp/Time setting SW located above the control panel. "/\" SW increases and "\/" decreases the rpm.	
7. Press SW1 again, once the adjusting is completed. High current supp valve is recorded on E^2PROM and will be confirmed. Indicators will stop flashing and will glow steadily.	
8. Return operation to normal by pressing the test mode SW (SW 5) again.	Displays temperature.

Note: The convection fan rpm changes by approximately 10~15 rpm each time "\/" or "/\" SW is pressed.

23. Gas Conversion

* Disconnect electrical supply and isolate gas supply.

1. Remove bottom trim. (see diagram 1)
2. Remove screws inside bottom louvre, pull complete front panel forward at bottom, unclip from escutcheon panel and remove from heater.
3. Replace small gas label on gas inlet.
4. Replace large gas label on back of appliance.
5. Place “new” very small gas label (indicating new gas type) over existing one on data plate.
6. Complete details on conversion sticker, place sticker on the inside front cover.
7. Undo main gas tube connection at manifold, push tube down.
8. Remove “O’ ring from manifold connection and refit to main gas tube (to avoid trapping “O” ring when re-assembling).
9. Remove manifold. Take care with gasket (see diagram 3).
10. Remove damper (3 screws). (see diagram 4)
11. Replace the damper.
12. Remove 2 injectors.
13. Fit new injectors (see diagram 4)
14. Refit manifold, secure with screws. Take care with gasket.
15. Connect main gas tube; take care with “O” ring.
16. Reconnect appliance to electricity and gas.
17. Follow gas pressure setting procedure, (see next page).
18. Check for gas escapes.
19. Replace front cover

Diagram 1.

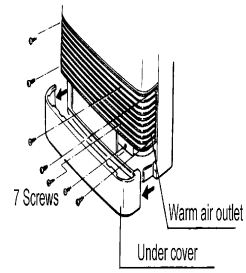


Diagram 2.

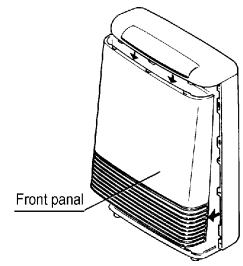


Diagram 3.

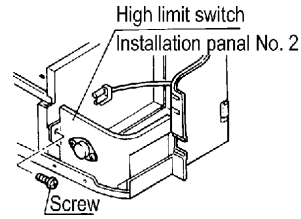


Diagram 4.

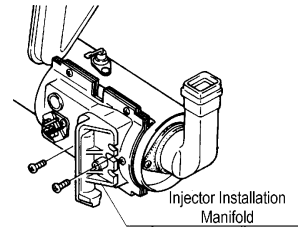


Diagram 5

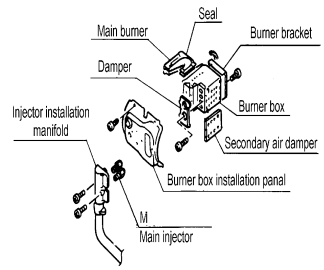
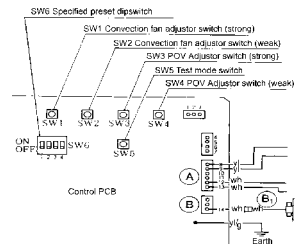
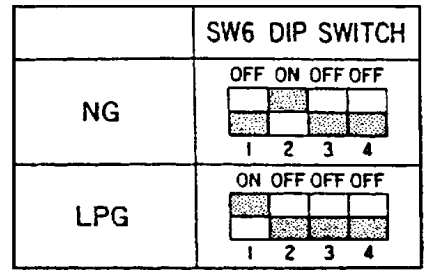


Diagram 6


SW6 Specified preset dipswitch
SW1 Convection fan adjustor switch (strong)
SW2 Convection fan adjustor switch (weak)
SW3 POV Adjustor switch (strong)
SW5 Test mode switch
SW4 POV Adjustor switch (weak)
Control PCB
Earth

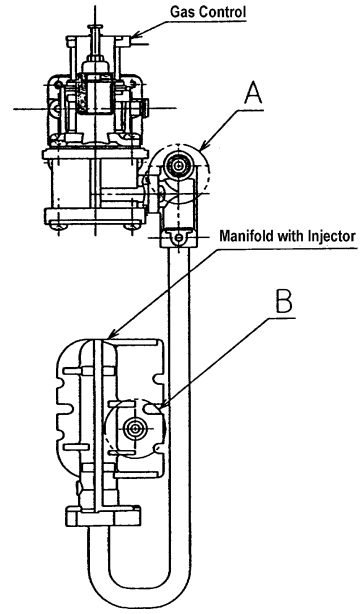
24. Gas Pressure Setting Procedure

1. Set dip switch (SW6) to correct position (see diagram opposite).
2. Remove test pressure point screws from heat exchanger manifold (B) and gas valve (A). Connect pressure gauge to both test points (connect one side of gauge to one point, and the other side of the gauge to the opposite point). If using an electronic manometer, connect th ⊖ side to the heat exchanger test point and ⊕ side to the gas valve test point.
3. Turn appliance ON.



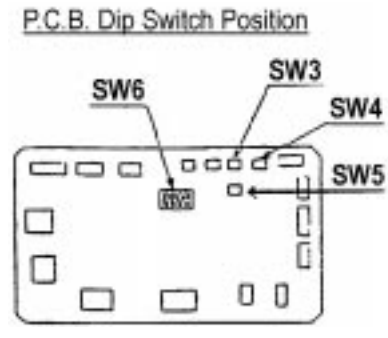
LOW

4. When the combustion indicator comes on, push SW5 once (see PCB dip switch position opposite).
5. Adjust the LOW pressure to the correct pressure (see table below) with the "/\" and "\/" buttons on the control panel. (The RHFE-308FTR has E^2PROM operation; there should be no need to adjust the modulating valve screw).
6. Press SW4 again to lock in the low pressure setting.

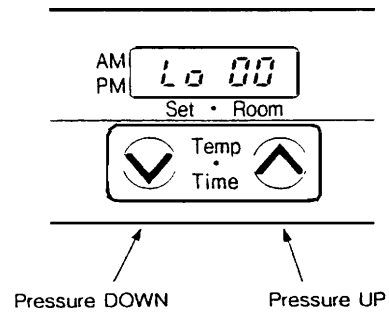


HIGH

7. Press SW3 to set the appliance on forced HIGH.
8. Adjust the HIGH pressure to the correct pressure (see table below) using the "\/" and "/\" buttons on the control panel.
9. Press SW3 again to lock in the high pressure setting.
10. Press SW5 again to return the appliance to normal operation.
11. Turn the appliance OFF.
12. Disconnect the pressure gauge and replace the test point screw.



	Natural Gas	Propane Gas
HIGH	0.60 kPa	1.04 kPa
LOW	0.12 kPa	0.19 kPa



25. Dismantling for service

NOTE: Before proceeding with dismantling, be sure to follow the **CAUTION** instructions before each explanation.

Item		*Page*
1.	Removal of the Front Panel	45
2.	Removal of the Top Panel, Control Panel / PCB Unit	45
3.	Removal of the Convection Fan Motor	46
4.	Removal of the Heat Exchanger	46
5.	Removal of the Burner	47
6.	Removal of the Flame Rod	48
7.	Removal of the Main PCB	48
8.	Removal of the Combustion Fan	49
9.	Removal of the Sparker PCB	49
10.	Removal of the Main Transformer	49
11.	Removal of the Gas Control	49
12.	Removal of the RoomTemperature Thermistor	50
13.	Removal of the Thermal Fuse	50

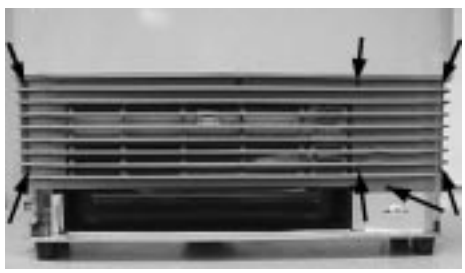
Unless otherwise stated, re-assembly is the reverse of dismantling

1) Removal of Front Panel

CAUTIO
240 volt potential inside applaince.
Disconnect electrical supply.

a. Grip sides of skirt and pull forward to remove.

b. Remove seven (7) screws to release louvre & front panel.



c. Grip bottom left and right hand corners of front panel, pull forward to release.

2) Removal of Top Panel, Control Panel, and Control Panel PCB.

CAUTION
240 volt potential inside applaince.
Disconnect electrical supply.

a. Remove front panel assembly, see section 1.
b. Remove (2) two screws, one on each side of control panel.

c. Release (3) three multi-pin connectors from main PCB, releasing the control panel PCB harness from wire clip on main PCB casing.
d. Lift both sides of ocntrol panel and pull forward to remove.

e. Grip control panel cover and lift up, applying light strength on one side to disconnect the hinge pin from control assembly.

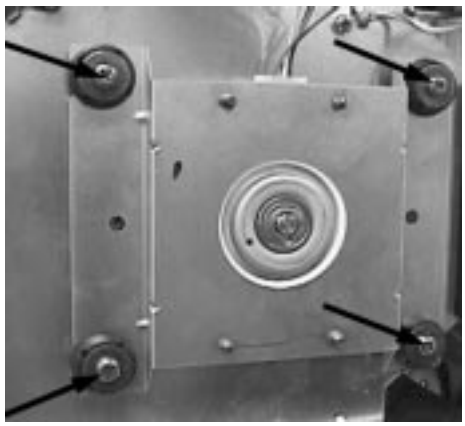
f. Unscrew seven (7) screws to remove control PCB from control panel.

3) Removal of Convection Fan Motor

CAUTIO
240 volt potential inside appliance
Disconnect electical supply.

a. Remove front panel assembly, see section 1.
b. Remove top panel and control panel assembly, see section 2 b)~d).
c. Loosen allen screw securing the fan blade to the fan motor shaft using a 3 mm allen key (from back of unit).

d. Remove four (4) screws securing the motor to the casing and remove fan motor cover.

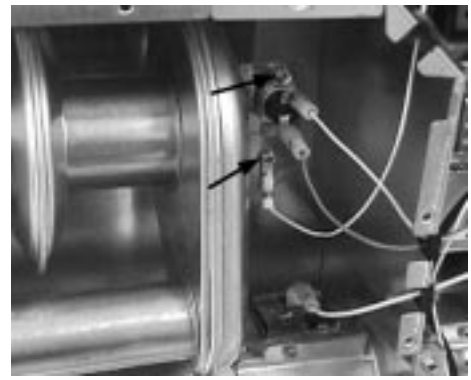


4) Removal of Heat Exchanger

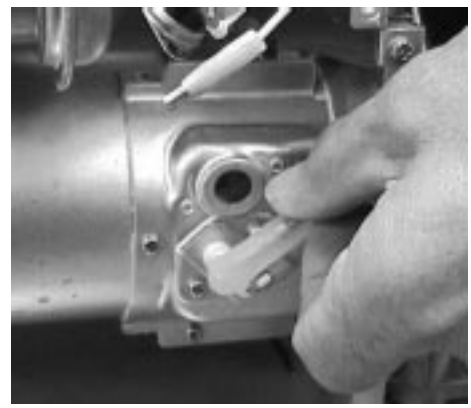
CAUTION
240 volt potential inside appliance
Disconnect electical supply.

a. Remove front panel assembly, see section 1.
b. Remove one (1) earth connection on front heat shield.
c. Release fusible link (pull down) on front of heat shield.
d. Release five (5) screws securing heat shield.

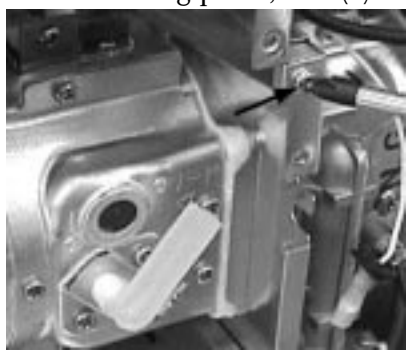
e. Disconnect overheat switch and thermistor, two (2) screws.



f. Disconnect flame sensing lead (pull hard).
g. Remove spark sensing lead, and high tension lead (pull off gently).



h. Remove blanking panel, one (1) screw.

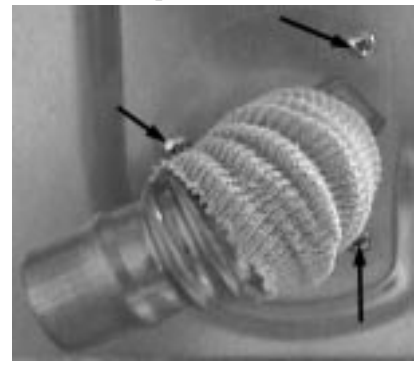


i. Remove side panel, one (1) screw.

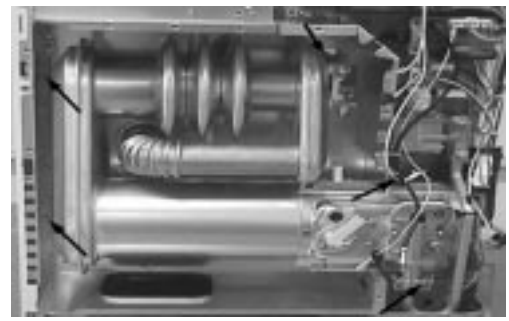
j. Remove one (1) gas supply tube securing screw and one (1) air intake tube securing tube.

k. Rotate clip at end of gas supply tube and push down on tube to release from manifold.
l. Disengage gas supply tube.
m. Remove two (2) burner securing screws and cable tie, to remove gas supply tube.

n. Remove flue spigot, three (3) screws.



o. Remove five (5) heat exchanger securing screws.



p. Grip heat exchanger and pull forward to remove.

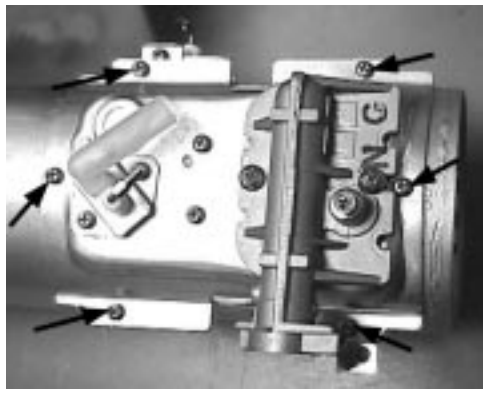
Note: Refer section 5 f)~g) to disconnect burne from heat exchanger complete assembly.

5) Removal of Burner

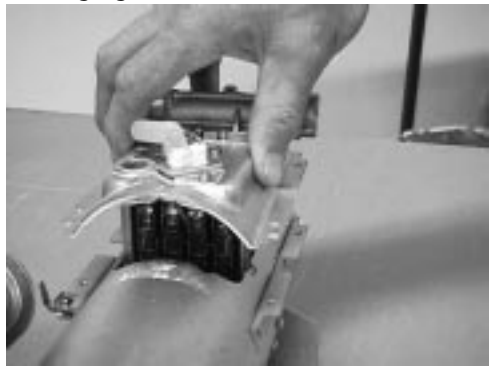
CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove front panel assembly, see section 1.
b. Remove front heat shield, see section 4 b) ~ d).
c. Remove blanking panel, one (1) screw.
d. Remove spark sensing lead, and high tension lead (pull off gently).
e. Remove one (1) gas supply tube securing screw.

f. Remove six (6) burner cover screws.



g. Gently manoeuvre burner and cover forward and out of burner chamber by pulling on manifold. Take care not to damage gasket.



6) Removal of Flame Rod

CAUTIO
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove front panel assembly, see section 1.
b. Remove front heat shield, see section 4 b)~d).
c. Remove two (2) screws (using a stubby phillips screwdriver).

7) Removal of Main PCB

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

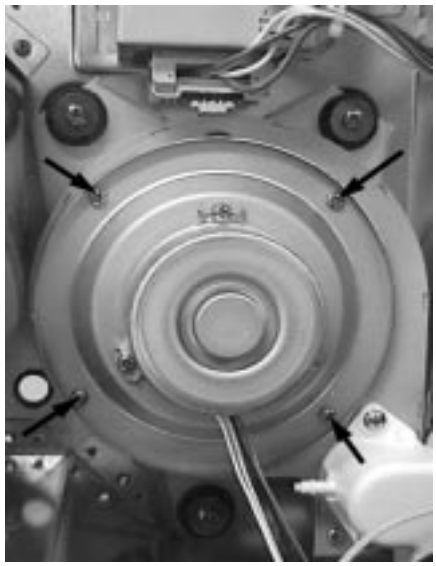
a. Remove front panel assembly, see section 1.
b. Release PCB by removing two (2) screws on left hand side.

c. Lift PCB on right hand side and gently manoeuvre it out.
d. Disconnect all multi-pin connectors, and wire harness from clips of PCB casing.
e. Remove one (1) earth connection on front heat shield and one (1) earth connection on convection fan housing.

8) Removal of Combustion Fan

CAUTIO
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove front panel assembly, see section 1.
b. Remove main PCB, see section 7 b)~e).
c. Remove four (4) combustion fan securing screws.



d. Grip fan motor plate and pull forward to remove fan from casing.
e. Remove connector from fan motor.

Note: Arrow should be aligned when fan assembly is replaced.

9) Removal of Sparker PCB

CAUTIO
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove front panel assembly, see section 1.
b. Remove one (1) earth lead from heat shield.
c. Disconnect 5-pin power supply connector.
d. Unclip sparker PCB from main PCB housing from securing lugs on side.

10) Removal of Main Transformer

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

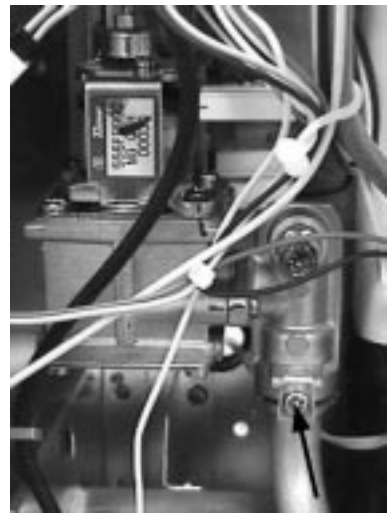
a. Remove front panel assy, see section 1.
b. Remove main PCB, see section 7 b)~e).
c. Remove one (1) securing screw from transformer mounting bracket.

d. Pull forward.

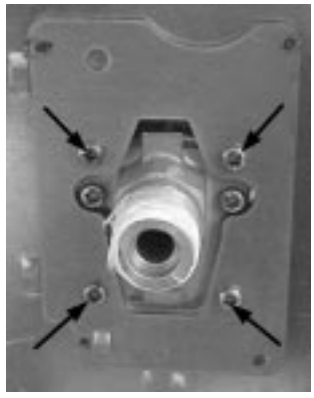
11) Removal of Gas Control

CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Turn off gas supply at the meter and disconnect appliance from installation.
b. Remove front panel assy, see section 1.
c. Release solenoid connectors and gas supply tube securing screw (1), release gas supply tube. Take care with O-ring.



d. Remove four (4) screws surrounding the gas inlet flange at back of heater.



e. Pull gas control assembly forward to remove from appliance.

Note: Ensure test point screw is fitted to gas controls, if fitting new control.

12) Removal of Room Thermistor

Note: Room temperature thermiator and heat exchanger overheat thermistor are connected together as one harness.

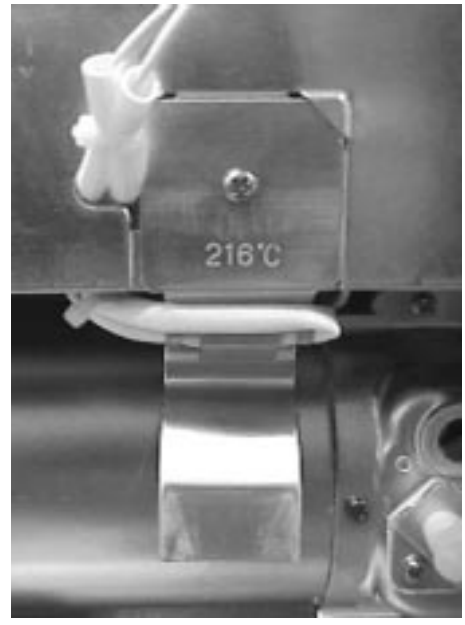
CAUTIO
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

a. Remove front panel assembly; see section 1.
b. Remove top and right hand side rear spacer panels.
c. Reach in behind appliance and unclip thermistor from purse locks.
d. Remove five (5) screws securing heat shield and lift heat shield off; see section 4-c)~d).
e. Remove overheat thermistor; see section 4-e).

13) Removal of Thermal Fuse

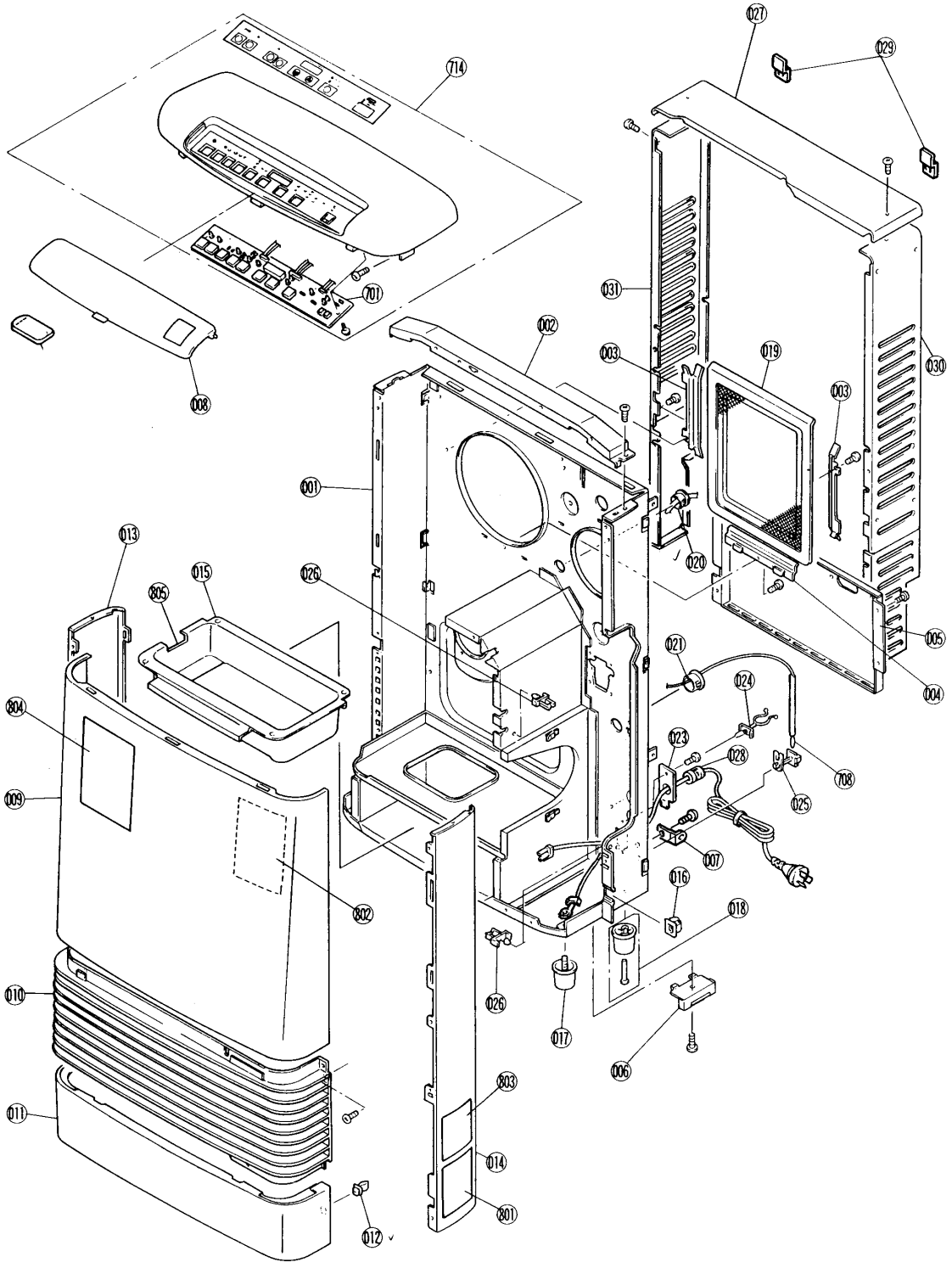
CAUTION
240 volt potential exposure. Isolate the applaince and reconfirm with a neon screwdriver or multimeter.

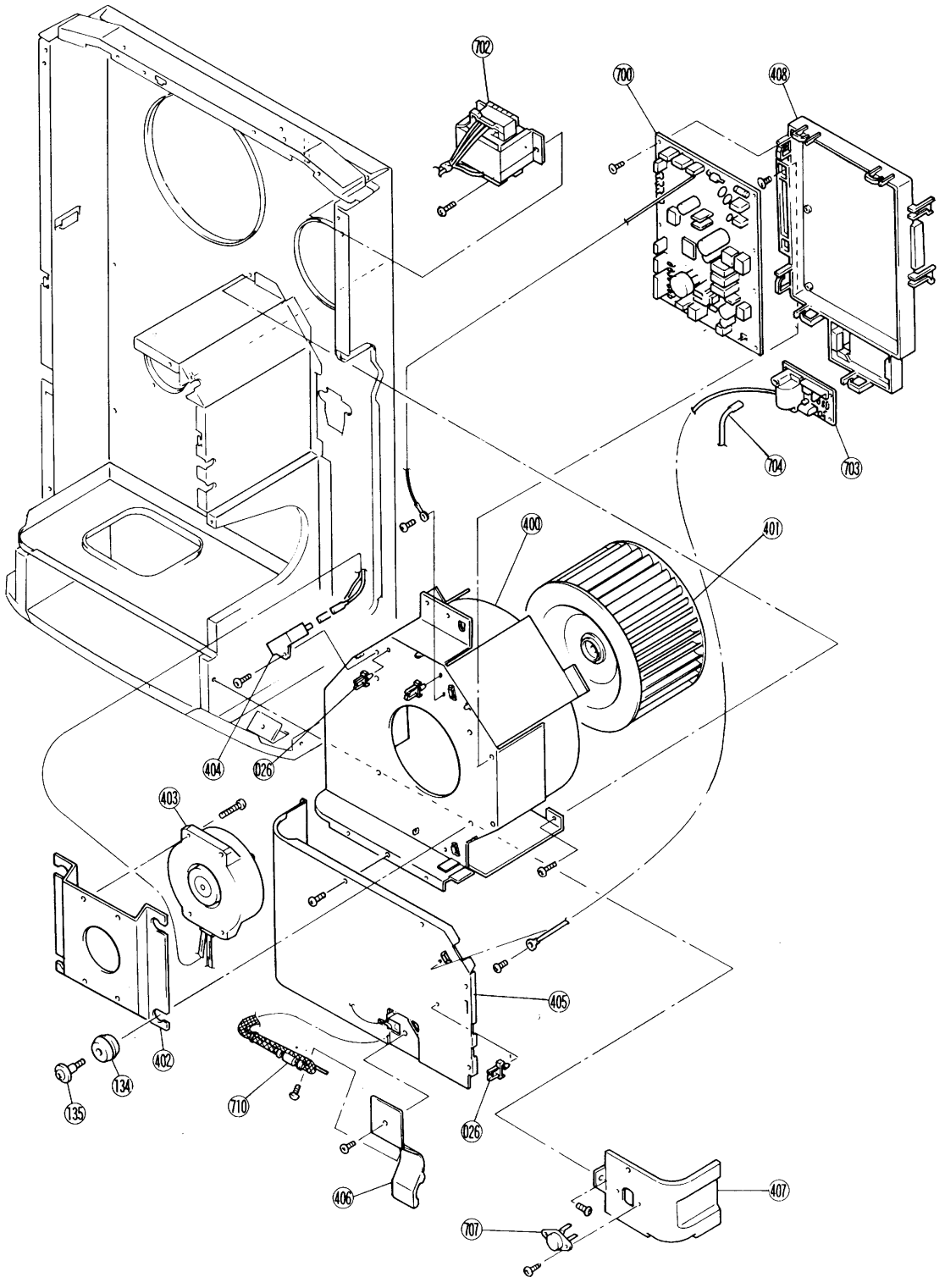
a. Turn off gas at meter and disconnect appliance from installation.
b. Remove front panel assembly; see section 1.
c. Unclip thermal fuse from support bracket (pull down).



d. Disconnect wire connector along harness to release completely from appliance.

26. Exploded Diagram

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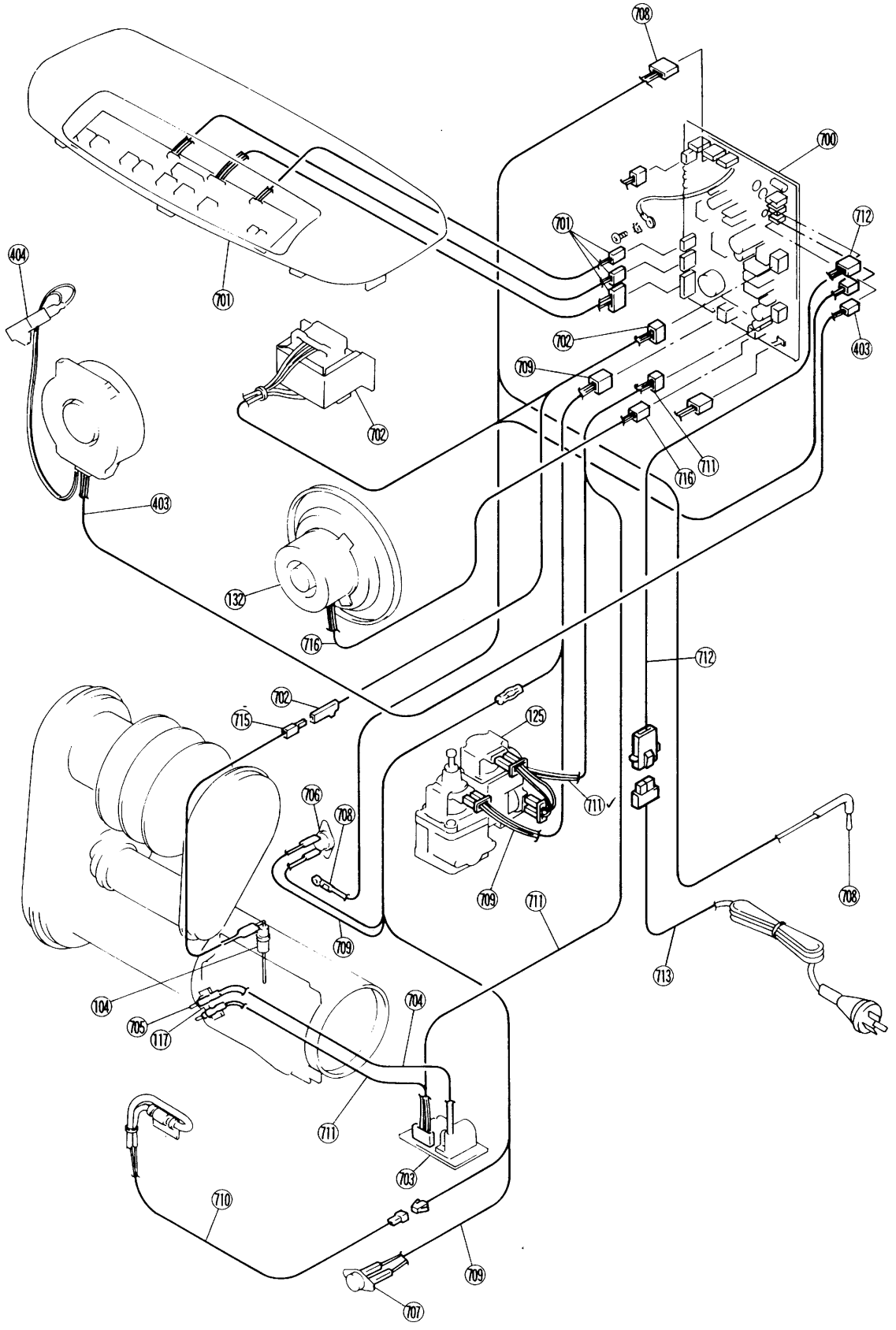
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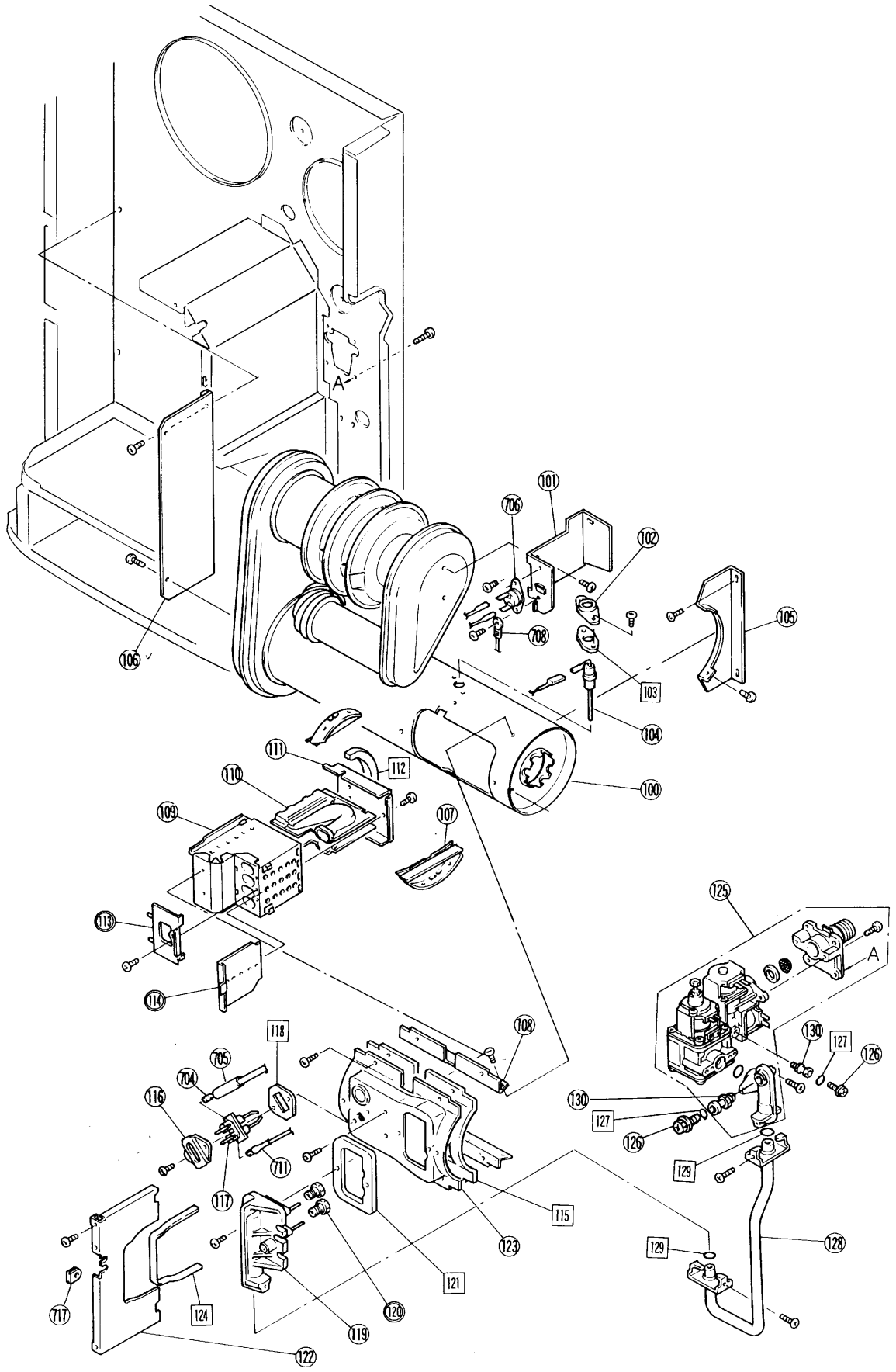
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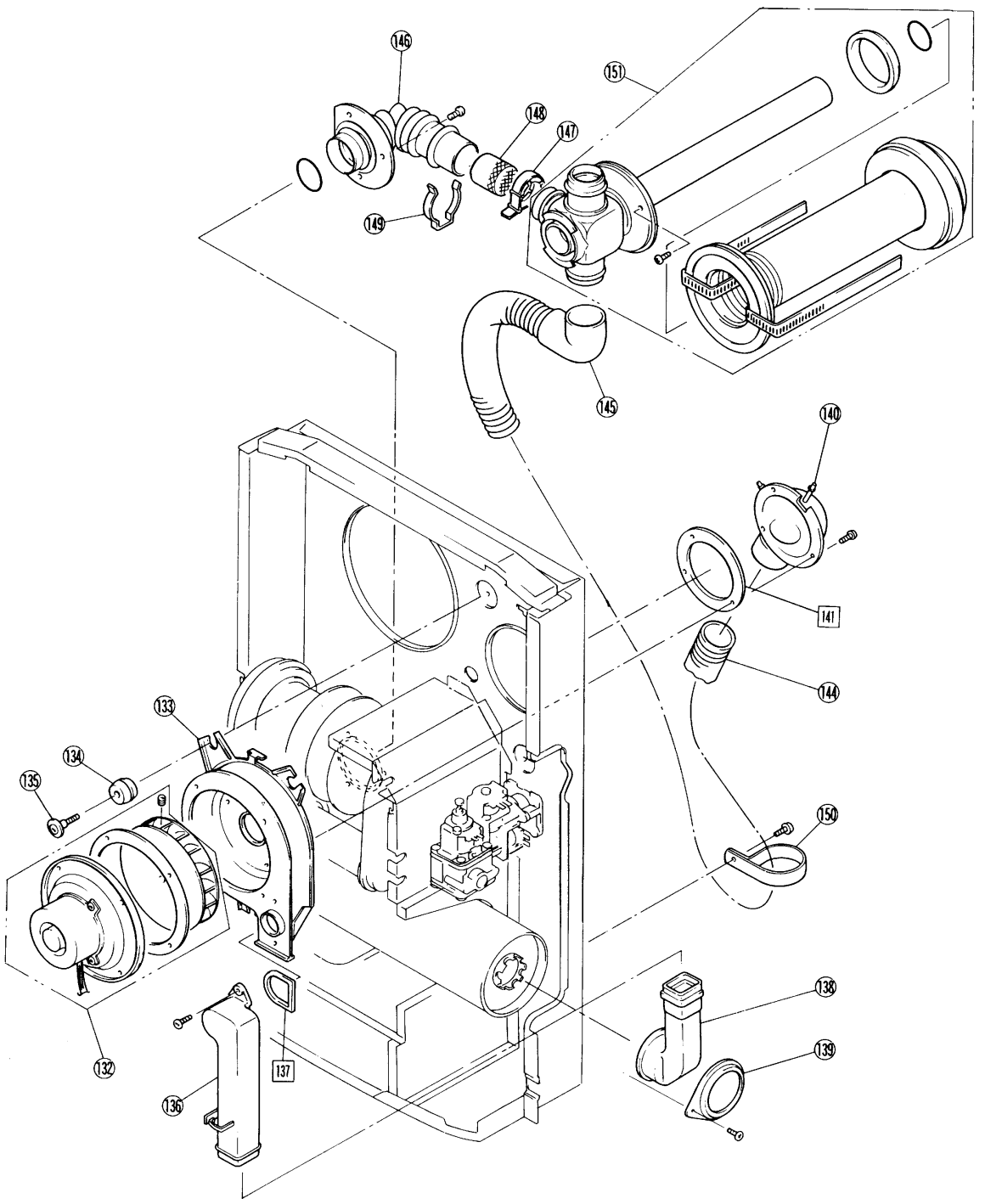
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27. Parts List

No	Part Name	RA Part No	RNZ Part No	QTY
001	Rear Panel Assembly A	90104367		1
002	Top Panel Support			1
003	Filter Clip, Side	90102161		2
004	Filter Clip	90102179		1
005	Rear Panel Heat Shield			1
006	Floor Mounting Bracket		3541	2
007	Back Spacer Bracket		3542	2
008	Control Cover Assembly	90115114	3545	1
009	Front Panel B	90113358	3546	1
010	Louvre Assembly	90113887	3547	1
011	Bottom Trim Assembly B	90115106	3548	1
012	Strike		3038	2
013	L/H Side Panel B	90113317	3549	1
014	R/H Side Panel B	90113333	3553	1
015	Humidifier Tray	90113390	3554	1
016	Latch		3028	2
017	Front Foot	90165663	3403	2
018	Foot	90165655	3405	2
019	Air Filter Assembly B	90113150	3576	1
020	Bush			1
021	Bush			1
023	Electrical Cord Fixing Plate	90177114		1
024	Cable Clip		6698	2
025	Thermistor Holder	90165267	4252	1
026	Wiring Clip		2043	2
027	Back Spacer, Top B	90103409	3577	1
028	Cord Bush	90177106	2048	1
029	Clip		6684	2
030	Back Spacer, R/H Assembly	90103417	3578	1
031	Back Spacer, L/H Assembly	90171026	3579	1
100	Heat Exchanger Complete Assembly	90120387	3580	1
101	OHS Bracket			1
102	Flame Rod Bracket			1
103	Flame Rod Packing	90173113	3069	1
104	Flame Rod		4299	1
105	Combustion Chamber Fixing Bracket			1

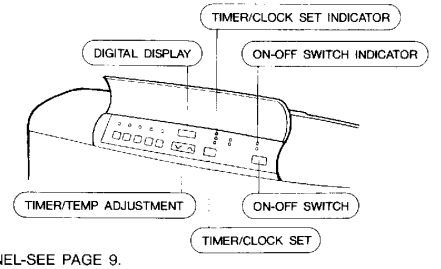
No	Part Name	RA Part No	RNZ Part No	QTY
106	Heat Exchanger Bracket			1
107	Sealing Bracket Assembly			2
108	Flange			2
109	Burner Box Assembly			1
110	Burner Assembly	90170630	3091	2
111	Burner Clip Assembly			1
112	Burner Box Packing	90175662	4231	1
113	Primary Air Damper (Propane/LPG)	90179144	3588	1
113	Primary Air Damper (NG)	90179466	3592	1
114	Secondary Air Damper (Propane/LPG)	90179474	3593	1
114	Secondary Air Damper (NG)	90179482	3594	1
115	Fixing Plate Packing	90175670		1
116	Electrode Bracket		3096	1
117	Electrode	90175696	3097	1
118	Electrode Packing	90173105	3098	1
119	Injector Manifold	90121757		1
120	Main Injector (Propane/LPG)	90159658	2393	2
120	Main Injector (NG)	90159633	3092	2
121	Manifold Packing		3094	1
122	Warm Air Sealing Bracket			1
123	Burner Box Mounting Plate Assembly			1
124	Heat Exchanger Packing B	90175563	4306	1
125	Gas Control Assy A (Prop/LPG-production only)	90120312	3595	1
125	Gas Control Assy C (NG - common spare)	90176520	3596	1
126	Pressure Test Point Screw			3
127	O-Ring		2239	3
128	Gas Supply ConnectionTube Assembly	90123134	3856	1
129	O-Ring		2389	2
130	Pressure Test Point		4204	2
132	Combustion Fan Complete Assembly	90117029	3995	1
133	Combustion Fan Casing Assembly			1
134	Mounting Rubber		4364	7
135	Motor Fixing Screw			3
136	Combustion Chamber ConnectionTubeTop		3996	1
137	ConnectionTube Packing		3997	1
138	Combustion Chamber ConnectionTube Bottom		3998	1
139	Rubber Connection Tube Clip		3103	1
140	Air Inlet C	90123043	4367	1
141	Air Inlet Packing		4053	1

No	Part Name	RA Part No	RNZ Part No	QTY
144	Flexible Intake Hose	90122961	4041	1
145	Air Inlet Elbow	90122953	4040	1
146	Flue Elbow Assembly		3999	1
147	Stopper Clip Assembly	90165358	3455	1
148	Elbow Cover		4371	1
149	Ring	90165374	4171	1
150	Clamp	90178146	4373	2
151	Mushroom Flue A			1
400	Convection Fan Casing Assembly			1
401	Sirroco Fan Assembly	90116872	4391	1
402	Motor Base			1
403	Convection Fan Motor & Harness	90116328	4392	1
404	Capacitor	90179490	3107	1
405	Heat Shield			1
406	Thermal Fuse Fixing Panel			1
407	OHS 2 Mounting Bracket			1
408	P.C.B. Mounting Bracket			1
700	P.C.B.	90120288	4393	1
701	Control Panel PCB Assembly	90179136	4394	1
702	Transformer - Australia	90117011		1
702	Transformer - New Zealand		3116	1
703	Sparker	90175829	2958	1
704	High Tension Cord Assembly B		4383	1
705	Electrode Sleeve		3395	1
706	Over Heat Switch (130^{o}C)	90178567	4385	1
707	Over Heat Switch (90^{o}C)	90178575	4384	1
708	Room Temperature & Overheat Thermistor Assy	90177502	4386	1
709	Solenoid Valve Harness		4389	1
710	Thermal Fuse Harness	90120544	4395	1
711	Main Harness Assembly		4387	1
712	Electrical Cord Assembly		4396	1
713	Power Cord Assembly		3115	1
714	Top Panel Complete Assembly		4397	1
715	Flame Rod Lead		4398	1
716	Combustion Motor Harness A		4399	1
717	Cord Packing			1

SETTING THE CLOCK

When the appliance is first plugged in and then turned on, the Digital Display will show - - : - -.

As an example, let's set the clock to 10:35 am.

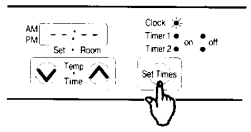


OPEN THE CONTROL PANEL-SEE PAGE 9.

1

When the appliance is first plugged in or after a power failure, the Digital Display will show - - : - -.

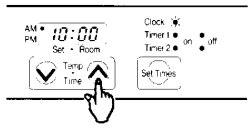
Press the Set Times button once, the Clock Indicator will flash.

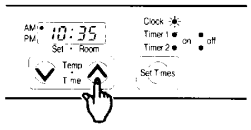


2

Press and hold the "▲" button; the minutes will begin to change first, then the time will change by whole hours. Release the button when AM 10:00 shows on the Digital Display. Confirm that you have selected AM, a small indicator on the left hand side of the Digital Display indicates the AM setting.

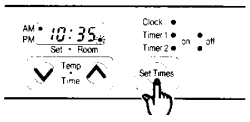
Press and hold the "▲" button again, release the button when AM 10:35 shows. If you go past AM 10:35, then the "▼" button can be used to change the time settings in reverse.





3

Press the Timer Set button five times to lock in and complete setting the time. The Clock and Timer indicators will go out. A small indicator on the Digital Display will flash to show that the



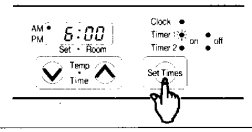
PROGRAMMING THE ON/OFF TIMER(S)

Before programming the Timers you must ensure that the clock has been set to the correct time. See "Setting the Clock".

As an example let's programme Timer 1 to heat the room by 7:10 AM and finish at 9:00 AM.

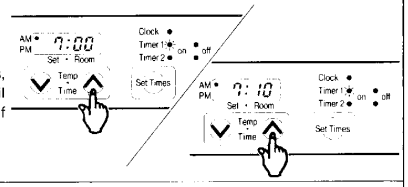
1

Press the Set Times button twice. The Digital Display will show AM 6:00. Timer 1 indicator will flash.



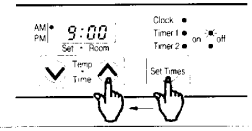
2

Press the "▲" button until AM 7:00 appears, release the button, then press it again until AM 7:10 appears. (Press the "▼" button if you go past AM 7:10.)



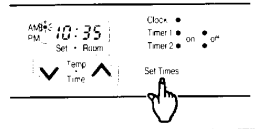
3

Press the Set Times button again, the Timer 1 OFF indicator will flash. Press the "▲" button until AM 9:00 appears.



4

Press the Set Times button three times to lock in the programmed time. The Digital Display will show the current time. A small indicator on the Digital Display will flash to show that the Display has returned to the clock.



TIMER 2 is programmed in the same way, remember to ensure that the Timer 2 indicator is flashing when you programme in the desired setting.
The Timers can be programmed to operate for any two periods in any 24 hours. Turn to next page to operate the dual timer.
The programmed time must be selected and locked-in within one minute of the On Timer indicators flashing otherwise the programmed times will not be retained in the system memory.

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	Emergency Hot Water	Tel: (08) 8345 5185
		140 Days Road, Ferryden Park, SA 5010
Western Australia:	**Service**	Tel: (08) 9478 3355 Fax: (08) 9277 2531
	Emergency Hot Water	Tel: (08) 9324 4145
		18 Belgravia Street, Belmont, WA 6104
Queensland:	**Service**	Tel: (07) 3209 4622 Fax: (07) 3209 4722
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